

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

MANUFACTURING ENGINEERING

EDUCATIONAL AND PROFESSIONAL PROGRAM

first (bachelor's) level of higher education

Specialty	131 Applied Mechanics
Areas of knowledge	13 Mechanical engineering
Qualification	Bachelor of Applied Mechanics

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:

Head of working group

*Yuriy Petrakov – Doctor of Technical Sciences, Professor,
Professor of the Department of Mechanical Engineering Technology*

Members of the working group:

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

*Yulia Lashyna– Ph.D., Associate Professor of the Department of Mechanical
Engineering Technology*

*Vadym Medvediev – Ph.D., Associate Professor, Associate Professor of the
Department of Mechanical Engineering Technology*

The Department of Mechanical Engineering Technology is responsible for the preparation of higher education applicants for the educational program

AGREED:

Scientific and methodological commission of the University in the specialty 131 Applied Mechanics

Head of NMCU 131

Mykola BOBYR

(Protocol № 4 from 19.02.2021)

Methodical Council KPI them. Igor Sikorsky

Head of the Methodical Council

Yurii YAKYMENKO

(Protocol № 6 from 25.02.2021)

CONSIDERED:

Recommendations for updating educational programs and features of the development of bachelor's training curricula (Report of Igor Sikorskyi KPI dated November 30, 2020 №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 components has been changed accordingly.

The educational program was discussed after receiving all wishes and proposals was approved at an extended meeting of the Department of Mechanical Engineering Technology (Protocol №6 of 18.01.2021).

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1. PROFILE OF THE EDUCATIONAL PROGRAM

from specialty 131 Applied Mechanics

1 – General information	
Full name of higher education institution and institute/faculty	National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", Mechanical Engineering Institute
Higher education degree and title of qualification in the original language	The degree is a bachelor's degree. Qualification – Bachelor of Applied Mechanics
Official name of op	Manufacturing Engineering
Type of diploma and volume of OU	Bachelor's degree, single, 240 credits, term of study 3 years 10 months
Availability of accreditation	Certificate of accreditation of the specialty ND 1192553, valid until 01.07.2023, issued by the Ministry of Education and Science of Ukraine
Cycle/Level OF	NRC of Ukraine – Level 6 QF-EHEA – First Cycle EQF-LLL – Level 6
Prerequisites	Availability of complete secondary education
Language(s) of teaching	Ukrainian / English
Validity period of op	Until the next accreditation
Internet address of permanent placement of the educational program	http://mmi.kpi.ua/op http://tm-mmi.kpi.ua/ https://osvita.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 conditions of transformation of the labor market through interaction with employers and other stakeholders. 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 the KPI. Igor Sikorsky Kyiv Polytechnic Institute for 2020-205: https://kpi.ua/2020-2025-strategy.</p>	
3 – Characteristics of the educational program	
Subject Area	<ul style="list-style-type: none"> - object of activity: structures, machines, equipment, mechanical and biomechanical systems and complexes, processes of their design, manufacture, research and operation; - training objectives: professional engineering activities in the field of design, production and operation of technical systems, machinery and equipment, robotics and complexes, development of technologies of machine-building industries; - theoretical content of the subject area: general laws of theoretical mechanics and their applied applications, theoretical foundations of machinery design, technologies of machine-building industries, mechanics of liquid and gases, parts of machines and structures, forecasting of operational properties of technical systems; - methods, methods and technologies: physical and mathematical methods for calculating statics, dynamics and stability of elements and structures; analytical, numerical and algorithmic methods of modeling kinematics and dynamics of machines,

	analysis of stress-deformed state of structural elements; design, control, research, development of technologies for manufacturing and assembling elements of machines and structures; information technologies in engineering research, design and production; methods and means; numerical software control of technological equipment; technologies of automated machine-building industries; - tools and equipment: machine tools, tools, technological and control devices, control and measuring instruments, numerical control systems, drives of machine and robotic systems.
Op orientation	Educational and professional The structure of the program involves the modern mastery of the methodology of existing methods for 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 the relevant sciences.
The main focus of the OP	Special education in the field of applied mechanics and machine-building. That involves deep knowledge of processing on CNC machines and management of processing processes in production. Keywords: applied mechanics, mechanical engineering
Features of op	The implementation of the program involves the involvement of professionals – practitioners, industry experts, representatives of employers in classroom classes: individual special courses of applied mechanics and mechanical engineering can be taught in English
4 – Suitability of graduates for employment and further study	
Suitability for employment	According to the classifier of professions DK 003:2010
Further training	The possibility of continuing training at the second (master's) level of higher education and / or acquiring additional qualifications in the system of postgraduate education.
5 – Teaching and evaluation	
Teaching and learning	Lectures, practical and seminar classes, computer workshops and laboratory work; course projects and works; technology of mixed learning, practice and excursions and attestation work
Evaluation	Assessment of students' knowledge is carried out in accordance with the Regulations on the system of evaluation of learning outcomes at the KPI. Igor Sikorsky Kyiv Polytechnic Institute for all types of classroom and non-classroom work (current, calendar, semester control). The evaluation system provides for oral and written examinations, tests.
6 – Software competencies	
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 Competences (ZK)	ZK1. Ability to abstract thinking, analysis and synthesis. ZK2. Knowledge and understanding of the subject area and understanding of professional activity. ZK3. Ability to identify set and solve problems. ZK4. Ability to apply knowledge in practical situations. ZK5. Ability to work in a team. ZK6. Certainty and perseverance regarding the tasks and

	<p>responsibilities taken.</p> <p>ZK7. The ability to learn and master modern knowledge.</p> <p>ZK8. Ability to communicate in a foreign language.</p> <p>ZK9. Skills in the use of information and communication technologies.</p> <p>ZK10. Skills in carrying out safe activities.</p> <p>ZK11. Ability to act socially responsibly and consciously.</p> <p>ZK12. Ability to search process and analyze information from different sources.</p> <p>ZK13. Ability to evaluate and ensure the quality of work performed.</p> <p>ZK14. The ability to realize their rights and obligations as a member of society, to realize the values of civil (free democratic) society and the need for its sustainable development, the rule of law, human and citizen rights and freedoms in Ukraine.</p> <p>ZK15. 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, technology and technology, to use different types and forms of motor activity for active rest and conducting a healthy lifestyle.</p>
Professional competencies (FC)	<p>FC1. The ability to analyze materials, structures and processes based on the laws, theories and methods of mathematics, natural sciences and applied mechanics.</p> <p>FC2. 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>FC3. The ability to carry out technological and technical and economic assessment of the effectiveness of the use of new technologies and technical means.</p> <p>FC4. The ability to make the optimal choice of technological equipment, complete set of technical complexes, have basic ideas about the rules of their operation.</p> <p>FC5. The ability to use analytical and numerical mathematical methods to solve the problems of applied mechanics, in particular, to make calculations for strength, endurance, stability, durability, rigidity in the process of static and dynamic load in order to assess the reliability of parts and structures of machines.</p> <p>FC6. Ability to perform technical measurements, receive, analyze and critically evaluate the results of measurements.</p> <p>FC7. The ability to apply computerized design systems (CAD), manufacturing (CAM), engineering research (CAE) and specialized application software to solve engineering problems in applied mechanics.</p> <p>FC8. Ability to spatial thinking and reproduction of spatial objects, structures and mechanisms in the form of projection drawings and three-dimensional geometric models.</p> <p>FC9. The ability to present the results of their engineering activities in compliance with generally accepted norms and standards.</p>

	<p>FC10. The ability to describe and classify a wide range of technical objects and processes, based on a deep knowledge and understanding of basic mechanical theories and practices, as well as basic knowledge of related sciences.</p> <p>FC11. Ability to choose the optimal typical technological processes in the manufacture of products and structures</p> <p>FC12. 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</p> <p>FC13. The ability to reasonably choose typical components when designing a snap-in for a developed technological process</p> <p>FC14. The ability to make decisions on the choice of instrumental support for automated production.</p> <p>FC15. The ability to use modern mathematical methods to control technological processes, find analogues and correct existing processing schemes</p> <p>FC16. The ability to justify the choice, determine the working parameters of the equipment of automated production of machine-building enterprises and design their typical nodes</p> <p>FC17. The ability to create new technical objects of mechanical engineering, taking into account the principles of design and ergonomics</p> <p>FC18. Ability to design functionally oriented technological processes for the manufacture of aircraft parts</p> <p>FC19. Ability to ensure the manufacturability of products and processes of their manufacture, to monitor compliance with technological discipline in the manufacture of products</p> <p>FC20. Ability to choose typical components of equipment when equipping technological processes</p> <p>FC21. Ability to apply typical methods of quality control of products and objects in the field of professional activity</p> <p>FC22. Ability to design separate technological operations for cutting difficult-profile surfaces and assembling aircraft and using computer-aided design systems</p> <p>FC23. The ability to use robotics in technological systems of automated engineering.</p> <p>FC24. The ability to use professionally profiled knowledge and skills in the field of theoretical foundations of informatics and the practical use of computer technologies and programming basics to solve experimental and practical problems in the field of mechanical engineering.</p> <p>FC25. Ability to carry out technological and technical and economic assessment of the effectiveness of the use of new technologies and technical means.</p>
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7 – Programmatic learning outcomes

- RN1. Choose and apply for solving problems of applied mechanics suitable mathematical methods.
- RN2. Use knowledge of the theoretical foundations of fluid and gas mechanics, heat engineering and electrical engineering to solve professional problems;
- RN3. Perform calculations for strength, endurance, stability, durability, rigidity of machine parts.
- RN4. Evaluate the reliability of machine parts and structures in the process of static and dynamic load.
- RN5. Perform geometric modeling of parts, mechanisms and structures in the form of spatial models and projection images and design the result in the form of technical and working

- drawings.
- RN6. Create and theoretically justify the designs of machines, mechanisms and their elements on the basis of methods of applied mechanics, general principles of design, theory of interchangeability, standard methods for calculating machine parts.
- RN7. Apply regulatory and reference data to monitor compliance of technical documentation, products and technologies with standards, technical specifications and other regulatory documents.
- RN8. Know and understand the basics of information technology, programming, practically use application software to perform engineering calculations, information processing and experimental research results.
- RN9. Know and understand related industries (fluid and gas mechanics, heat engineering, electrical engineering, electronics) and be able to detect interdisciplinary connections of applied mechanics at the level necessary to meet other requirements of the educational program.
- RN10. Know the designs, methods of selection and calculation, the basics of maintenance and operation of machine and robotic equipment drives;
- RN11. Understand the principles of automated control systems for technological equipment, in particular microprocessor, to choose and use optimal automation tools.
- PH12. Skills in the practical use of computerized design systems (CAD), production preparation (SAM) and engineering research (CAE).
- PH13. Evaluate the technical and economic efficiency of production;
- PH14. To carry out the optimal choice of equipment and equipment of technical complexes.
- PH15. Take into account the main factors of technogenic impact on the environment and the main methods of environmental protection, labor protection and life safety when making decisions.
- PH16. Freely communicate on professional issues orally and in writing in the state and foreign language, including knowledge of special terminology and interpersonal skills.
Complicate algorithms and computer programs in programming languages using modern information technologies.
- RN18. Prepare the initial data to justify technical solutions, apply standard calculation methods when designing or choosing purchased equipment.
- RN19. Use the means of information technology design in the tasks of technical preparation of production.
- RN20. To conduct information and analytical research on a given topic.
- RN21. Perform observations, measurements, make a report on the studies conducted, analyze the results of research, and prepare data for reviews and scientific publications.
- RN22. Conduct experiments according to given methods with processing and analysis of results.
- RN23. Select the necessary equipment for the specified production conditions, perform according to known methods the calculation of structural elements and parameters of setting metal cutting machines, choose the necessary equipment for the specified production conditions, perform the calculation of structural elements and parameters of setting metal cutting machines according to known methods.
- RN24. Perform calculations of parameters of design objects and performance indicators of mechanisms, machines, structures
- RN25. Project separate technological cutting operations and technological processes of processing parts of machines of different classes, including with the use of computer-aided design systems
- RN26. Develop control programs for CNC machines for processing complex surfaces of machine parts blanks and means of mechanization and automation of technological processes
- RN27. Develop working design and technical documentation, draw up completed design work with verification of compliance of development projects and technical documentation with standards, technical specifications and other regulatory documents
- RN28. Provide modeling of technical objects and technological processes with using standard

<p>packages and tools for automating engineering calculations, conduct experiments according to the given methods with processing and analysis of the results</p> <p>RN29. Use mathematical methods in technology and mechanism design, machines, structures; apply standard calculation methods during design parts and assemblies of aircraft</p> <p>RN30. Perform technical and economic substantiation of the results of project decisions</p>	
8 – Resource support for the implementation of the program	
Staffing	In accordance with the personnel requirements for ensuring the implementation of educational activities for the appropriate level of THE approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 with changes entered in accordance with the Resolution of the Cabinet of Ministers of Ukraine №347 of 10.05.2018
Material and technical support	In accordance with the technological requirements for logistical support of educational activities of the relevant level of THE approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 with changes entered in accordance with the Resolution of the Cabinet of Ministers of Ukraine №347 of 10.05.2018. Use of equipment for lectures in the format of presentations, network technologies, in particular using the Sikorsky distance learning platform.
Information and educational-methodical support	In accordance with the technological requirements for educational, methodological and informational support of educational activities of the relevant level of THE approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 №1187 with changes entered in accordance with the Resolution of the Cabinet of Ministers of Ukraine №347 of 10.05.2018. Use of scientific and technical library KPI named after Igor Sikorsky.
9 – Academic mobility	
National Credit Mobility	On the basis of bilateral agreements between the National Technical University of Ukraine "Ihor Sikorskyi Kyiv Polytechnic Institute" and technical universities of Ukraine.
International Credit Mobility	On the basis of bilateral agreements between the National Technical University of Ukraine "Ihor Sikorskyi Kyiv Polytechnic Institute" and educational institutions of partner countries, agreements on international academic mobility.
Training of foreign applicants	Teaching in English with support study of the Ukrainian language as a foreign language or after study of the Ukrainian course by foreign applicants languages in groups of general training.

2. LIST OF COMPONENTS OF THE EDUCATIONAL PROGRAM

Code	Components of the educational program (disciplines, course projects / works, practices, qualification work)	Number of ECTS credits	Final control form
Mandatory (regulatory) components of the OU			
General training cycle			
ZO1	Ukrainian language for professional purposes	2	Test
ZO2	Ukraine in the context of the historical development of Europe	2	Test
ZO3	Basics of a healthy lifestyle	3	Test
ZO4	Foreign Language	6	Test
ZO5	Economics and organization of production	4	Test
ZO6	Labor protection and civil protection	2	Test
ZO7	Introduction to Philosophy	2	Test
ZO8	Business law	2	Test
ZO9	Foreign Language for Professional Purposes	6	Exam
Cycle of professional training according to the educational program			
PO1	Higher mathematics	17	Exam
PO2	Linear algebra	3,5	Test
PO3	Chemistry	3	Test
PO4	Technology of structural materials	4,5	Exam
PO5	General physics	10	Test /Exam
PO6	Engineering and computer graphics	4	Test
PO7	Materials Science	4,5	Exam
PO8	Theoretical mechanics	13	Test /Exam
PO9	Electrical engineering and electronics	3	Test
PO10	Informatics	4	Test
PO11	Mechanics of materials and structures	13	Exam
PO12	Mechanics of materials and structures Coursework	1	Test
PO13	Theoretical foundations of heat engineering	3	Test
PO14	Metrology, standardization and certification	4,5	Exam
PO15	Theory of mechanisms and machines	5	Exam
PO16	Theory of machines and machines Coursework	1	Test
PO17	Mechanics of liquid and gas	3,5	Test
PO18	Machine parts and design basics	4,5	Exam
PO19	Machine parts and design basics Course project	1,5	Test
PO20	Technology of mechanical engineering	19,5	Exam
PO21	Technology of mechanical engineering Course project	1,5	Test
PO22	Theory of automatic control of technological systems	4,5	Exam
PO23	Technological snap-in	4	Exam
PO24	Technological snap-in. Coursework	1	Test
PO25	Programming CNC machines	5	Exam
PO26	Pre-role practice	6	Test
PO27	Diploma design	6	Defense
Sample components of OU			
Selective components of general training			
ZV1	Educational component 1 ZU-Catalogue	2	Test
ZV2	Educational component 2 ZU-Catalogue	2	Test
Selective components of vocational training			
PV1	Educational Component 1 F-Catalogue	4	Test
PV2	Educational Component 2 F-Catalogue	4	Test

Code	Components of the educational program (disciplines, course projects / works, practices, qualification work)	Number of ECTS credits	Final control form
PV3	Educational Component 3 F-Catalogue	4	Test
PV4	Educational Component 4 F-Catalogue	4	Test
PV5	Educational Component 5 F-Catalogue	4	Test
PV6	Educational component 6 F-Catalogue	4	Test
PV7	Educational Component 7 F-Catalogue	4	Test
PV8	Educational component 8 F-Catalogue	4	Test
PV9	Educational Component 9 F-Catalogue	4	Test
PV10	Educational Component 10 F-Catalogue	4	Test
PV11	Educational component 11 F-Catalogue	4	Test
PV12	Educational component 12 F-Catalogue	4	Test
PV13	Educational Component 13 F-Catalogue	4	Test
PV14	Educational component 14 F-Catalogue	4	Test
Total required components:			180
Total number of selective components:			60
The volume of educational components that ensure the acquisition of competencies of certain CSOs			144,5
THE TOTAL SCOPE OF THE EDUCATIONAL PROGRAM			240

3. STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROGRAM



