

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

**Approved**

by Igor Sikorsky Kyiv Polytechnic Institute  
Academic Council

(protocol № \_\_ «\_\_» \_\_\_\_\_ 20\_\_.)

Head of the Academic Council

\_\_\_\_\_ Ilchenko Mykhailo

**ENGINEERING DESIGN TOOL SYSTEMS**

**EDUCATIONAL PROFESSIONAL PROGRAM**

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

**Specialty: 131 Applied mechanics**

**Field of knowledge: 13 Mechanical engineering**

**Qualification: Bachelor Degree in Applied mechanics**

Entered into force in 2021/2022 year  
by order of the rector

\_\_\_\_\_ 20\_\_ № \_\_\_\_\_

Kyiv – 2021

## **PREAMBLE**

### **DEVELOPED by the project team:**

*Project team leader:*

Vovk Vyacheslav, Assoc.Prof. of the Department of Machine Design, PhD.

*Members of the project team:*

Danilchenko Yuriy, Head of the Department of Machine Design, Doctor of Engineering., Prof.

Okhrimenko Alexander, Prof. of the Department of Machine Design, Doctor of Engineering, Assoc.Prof.

Adamenko Yuri, Assoc.Prof. of the Department of Machine Design, PhD, Assoc.Prof..

The head of the Department of Machine Design is responsible for the preparation of higher education students according to the educational program

### **AGREED:**

Scientific and Methodological Commission of the University in the specialty 131 Applied Mechanics (protocol № \_\_\_ «\_\_\_» \_\_\_\_\_ 20\_\_ y.)

Head of the SMCU 131

\_\_\_\_\_ Mykola BOBIR

Methodical council of Igor Sikorsky Kyiv Polytechnic Institute

Head of the Methodical council \_\_\_\_\_ Yuriy Yakymenko

(protocol № \_\_\_ «\_\_\_» \_\_\_\_\_ 20\_\_ y.)

### **TAKEN INTO ACCOUNT:**

Reviews, suggestions, suggestions of stakeholders, recommendations of professional associations, etc .: LLC with "BIBUS Ukraine", State Enterprise "Kyiv Armored Plant", State Enterprise "Zhulyansky Machine-Building Plant" VIZAR "»

Recommendations for updating educational programs and features of developing curricula for bachelors (Igor Sikorsky Kyiv Polytechnic Institute order from 30.11.2020 №HOH/35/2020 "On improving educational programs of the first (bachelor's) level of higher education") and accordingly changed the list of obligations and selective educational components

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 approved at an extended meeting of the Department of Machine Design (protocol №10 dated 14 January 2021).

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1. PROFILE OF THE EDUCATIONAL PROGRAM  
in the specialty 131 Applied Mechanics

<b>1 – General information</b>	
Full name of the higher education institution 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 of Applied Mechanics
The official name of the EP	Engineering Design Tool Systems
Type of diploma and scope of EP	Bachelor's degree, single, 240 credits, term of study 3 years 10 months
Availability of accreditation	Certificate of accreditation of the specialty НД 1192553, valid until 01.07.2023, issued by the Ministry of Education and Science of Ukraine
Cycle / level HE	NRC of Ukraine - level 6 QF-EHEA – the first cycle EQF-LLL – level 6
Prerequisites	Availability of complete secondary education
Language (s) of instruction	Ukrainian
Validity of the EP	Until the next accreditation
URL of the educational program	<a href="https://osvita.kpi.ua">https://osvita.kpi.ua</a> <a href="https://mmi.kpi.ua">https://mmi.kpi.ua</a> , <a href="https://itm.kpi.ua">itm.kpi.ua</a>
<b>2 – The purpose of the educational program</b>	
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 formation of high adaptability of higher education seekers in labor market transformation 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 KPI. Igor Sikorsky for 2020-2025 [ <a href="https://kpi.ua/2020-2025-strategy">https://kpi.ua/2020-2025-strategy</a> ].	
<b>3 – Characteristics of the educational program</b>	
Subject area	<ul style="list-style-type: none"> <li>- <b>object of activity:</b> structures, machines, equipment, mechanical and biomechanical systems and complexes, processes of their design, manufacture, research and operation;</li> <li>- <b>learning objectives:</b> professional engineering activities in the field of design, production and operation technical systems, machines and equipment, robotic means and complexes, development of technologies of machine-building productions;</li> <li>- <b>theoretical content of the subject area:</b> general laws of theoretical mechanics and their applied applications, theoretical principles of machine design, technology of machine-building industries, fluid and gas mechanics, machine parts and structures, forecasting the performance of technical systems;</li> <li>- <b>methods, techniques and technologies:</b> physical and mathematical methods for calculating statics, dynamics and stability of elements and structures; analytical, numerical and algorithmic methods of modeling the</li> </ul>

	<p>kinematics and dynamics of machines, analysis of the stress-strain state of structural elements; methods of design, control, research, development of technologies for the manufacture and assembly of elements of machines and structures; information technology in engineering research, design and production; methods and means of numerical software control of technological equipment; technologies of automated machine-building productions;</p> <p><b>- tools and equipment:</b> machines, tools, technological and control devices, control and measuring devices, numerical control systems, drives of machine and robotic systems.</p>
Orientation EP	<p>Educational and professional.</p> <p>The structure of the program provides a 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 application of certain theories and methods of relevant sciences.</p>
The main focus of the EP	<p>Special education in the field of applied mechanics and mechanical engineering.</p> <p>Key words: applied mechanics, mechanical engineering</p>
Features of EP	<p>Implementation of the program involves the involvement of professionals - practitioners, industry experts, representatives of employers: some special courses in applied mechanics and mechanical engineering can be taught in English</p>
<b>4 – Suitability of graduates for employment and further study</b>	
Suitability for employment	According to the classifier of professions ДК 003:2010
Further training	Possibility to continue studying at the second (master's) level of higher education and / or to acquire additional qualifications in the system of postgraduate education.
<b>5 – Teaching and assessment</b>	
Teaching and learning	Lectures, practical and seminar classes, computer workshops and laboratory works; course projects and works; technology of blended learning, practice and excursions; performance of attestation work
Evaluation	Assessment of students' knowledge is carried out in accordance with the Regulations on the system of assessment of learning outcomes in KPI. Igor Sikorsky for all types of classroom and extracurricular work (current, calendar, semester control); oral and written exams, tests.
<b>6 – Program competencies</b>	
Integral competence	Ability to solve complex specialized problems and practical problems in applied mechanics, or in the learning process, which involves the application of certain theories and methods of mechanical engineering and is characterized by complexity and uncertainty of conditions.
General competencies (GK)	GK1. Ability to abstract thinking, analysis and synthesis. GK2. Knowledge and understanding of the subject area

	<p>and understanding of professional activity.</p> <p>GK3. Ability to identify, pose and solve problems.</p> <p>GK4. Ability to apply knowledge in practical situations.</p> <p>GK5. Ability to work in a team.</p> <p>GK6. Definiteness and perseverance in terms of tasks and responsibilities.</p> <p>GK7. Ability to learn and master modern knowledge.</p> <p>GK8. Ability to communicate in a foreign language.</p> <p>GK9. Skills in the use of information and communication technologies.</p> <p>GK10. Safe activities skills.</p> <p>GK11. The ability to act socially responsibly and consciously.</p> <p>GK12. Ability to search, process and analyze information from various sources.</p> <p>GK13. Ability to evaluate and ensure the quality of work performed.</p> <p>GK14. Ability to exercise their rights and responsibilities 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 civil rights and freedoms in Ukraine.</p> <p>GK15. Ability to preserve and increase moral, cultural, scientific values and achievements of society based on 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, techniques and technologies. active recreation and a 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. Ability to evaluate the performance parameters of materials, structures and machines in operating 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. Ability to conduct technological and technical and economic assessment of the effectiveness of new ones technologies and technical means.</p> <p>PC4. Ability to make the optimal choice of technological equipment, technical equipment complexes, have a basic understanding of 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 calculate the strength, endurance, stability, durability, rigidity in the process of static and dynamic loading to assess the reliability of parts and structures of machines.</p> <p>PC6. Ability to perform technical measurements, obtain,</p>

	<p>analyze and critically evaluate measurement results.</p> <p>PC7. Ability to use computerized systems of design (CAD), production (CAM), engineering research (CAE) and specialized application software to solve engineering problems in applied mechanics.</p> <p>PC8. Ability to think spatial and reproduce spatial objects, structures and mechanisms in the form of projection drawings and three-dimensional geometric models.</p> <p>PC9. Ability to present the results of its engineering activities in compliance with generally accepted norms and standards.</p> <p>PC10. 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>PC11. Ability to determine rational schemes of surface shaping as a basis for designing tool systems for given machining conditions.</p> <p>PC12. The ability to recognize a rational type of tool for surface treatment of a given shape.</p> <p>PC13. Ability to design tools of standard design based on existing techniques.</p> <p>PC14. Ability to make decisions on the choice of tooling for automated production.</p> <p>PC15. Ability to comply with the requirements for the system of auxiliary tools and equipment for automated production.</p> <p>PC16. Ability to justify the choice, determine the operating parameters of the equipment of automated production of machine-building enterprises and design their typical components.</p> <p>PC17. Ability to create new technical objects of mechanical engineering taking into account the principles of design and ergonomics.</p>
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#### **7 – Program learning outcomes**

- LO1) select and apply to solve problems of applied mechanics suitable mathematical methods;
- LO2) use knowledge of the theoretical foundations of mechanics of liquids and gases, heat engineering and electrical engineering to solve professional problems;
- LO3) perform calculations on the strength, endurance, stability, durability, rigidity of machine parts;
- LO4) evaluate the reliability of machine parts and structures in the process of static and dynamic loading;
- LO5) 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;

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 of calculating machine parts;

LO7) apply regulatory and reference data to control the compliance of technical documentation, products and technologies with standards, specifications and other regulatory documents;

LO8) know and understand the basics of information technology, programming, practical use of application software to perform engineering calculations, information processing and experimental results research;

LO9) know and understand related fields (fluid and gas mechanics, heat engineering, electrical engineering, electronics) and be able to identify interdisciplinary connections of applied mechanics at the level necessary to meet other requirements of the educational program;

LO10) know the design, methods of selection and calculation, basics of maintenance and operation of machine tools and robotic technical equipment;

LO11) understand the principles of operation of automated control systems of technological equipment, in particular microprocessor, choose and use the optimal means of automation;

LO12) skills of practical use of computerized systems of design (CAD), preparation of production (SAM) and engineering researches (CAE);

LO13) evaluate the technical and economic efficiency of production;

LO14) to carry out the optimal choice of equipment and complete set of technical complexes;

LO15) take into account when making decisions the main factors of man-made impact on the environment and the main methods of environmental protection, labor protection and life safety;

LO16) communicate freely on professional matters orally and in writing in the state and foreign languages, including knowledge of special terminology and interpersonal skills;

LO 17) take into account the methods of formation of tool surfaces, the conditions of formation under which it is possible to manufacture a given surface of the part and methods for determining the family of enveloping curves and surfaces;

LO18) skills and features of application of designs of the cutting and auxiliary tool in automated production;

LO 19) features of designs, operation of auxiliary tools and equipment for different groups of CNC machines and modern designs of aggregate-modular systems of automated production tools;

LO20) features, technologies of making tools and equipment.

### **8 – Resource support for program implementation**

Staffing

In accordance with the personnel requirements to ensure 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 30.12.2015 № 1187 with changes made in



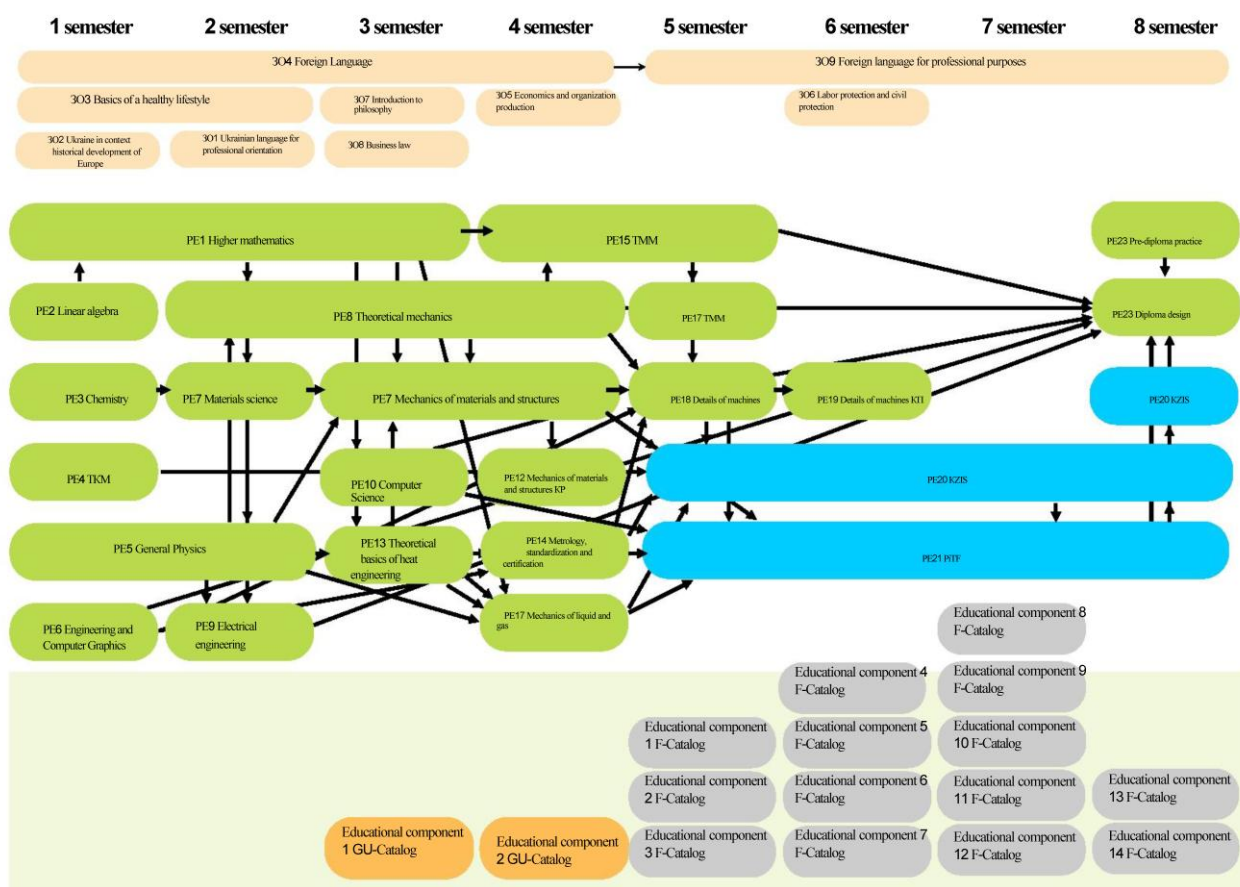
	accordance with the Resolution of the Cabinet of Ministers of Ukraine №347 10.05.2018.
Logistics	In accordance with the technological requirements for material and technical support of educational activities of the appropriate level of HE (Annex 4 to the License Conditions), approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 із 1187 as amended in accordance with the Resolution of the Cabinet of Ministers of Ukraine від347 dated 10.05.2018 Use of equipment for lectures in the format of presentations, network technologies, in particular on the distance learning platform Sikorsky.
Information, 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 (Annex 5 to the License Conditions), approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 as amended in accordance with the Resolution of the Cabinet of Ministers of Ukraine №347 10.05.2018 Use of the Scientific and Technical Library of Igor Sikorsky Kyiv Polytechnic Institute.
<b>9 – Academic mobility</b>	
National credit mobility	Based on bilateral agreements between Igor Sikorsky Kyiv Polytechnic Institute and technical universities of Ukraine.
International credit mobility	Based on bilateral agreements between Igor Sikorsky Kyiv Polytechnic Institute and educational institutions of partner countries, agreements on international academic mobility.
Training of foreign applicants HE	Possibility of teaching in Ukrainian in general training groups or in English with the provision of learning Ukrainian as a foreign language

## 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 final control
<b>Mandatory (regulatory) components of the EP</b>			
<b>General training cycle</b>			
GE1	Ukrainian language for professional purposes	2	credit
GE2	Ukraine in the context of the historical development of Europe	2	credit
GE3	Basics of a healthy lifestyle	3	credit
GE4	Foreign Language	6	credit
GE5	Economics and organization of production	4	credit
GE6	Labor protection and civil protection	2	credit
GE7	Introduction to philosophy	2	credit
GE8	Business law	2	credit
GE9	Foreign language for professional purposes	6	exam

Code	Components of the educational program (academic disciplines, course projects / works, practices, qualification work)	Number of ECTS credits	Form final control
<b>Cycle of professional training according to the educational program</b>			
PE1	Higher mathematics	17	exam
PE2	Linear algebra	3,5	credit
PE3	Chemistry	3	credit
PE4	Technology of Construction Materials	4,5	exam
PE5	Physics	10	credit/exam
PE6	Computer and Engineering Graphics	4	credit
PE7	Materials Science	4,5	exam
PE8	Theoretical Mechanics	13	credit/exam
PE9	Electrical Engineering	3	credit
PE10	Informatics	4	credit
PE11	Mechanics of Materials and Structures	13	exam
PE12	Mechanics of Materials and Structures (TP)	1	credit
PE13	Theoretical foundations of heat engineering	3	credit
PE14	Metrology and Standardization	4,5	exam
PE15	Theory of mechanisms and machines	5	exam
PE16	Theory of mechanisms and machines (TP)	1	credit
PE17	Mechanics of liquid and gas	3,5	credit
PE18	Machine Parts	4,5	exam
PE19	Mechanics of liquid and gas (TP)	1,5	credit
PE20	Design support of tool systems	17	exam
PE21	Design support of tool systems (CP)	1,5	credit
PE22	Processes and technology of formation	17	credit/exam
PE23	Pre-diploma practice	6	credit
PE24	Diploma design	6	protection
<b>Selective component EP</b>			
<b>Selective components of general training</b>			
GS1	Educational component 1 General University-Catalog	2	credit
GS2	Educational component 2 General University-Catalog	2	credit
<b>Selective components of professional training</b>			
PS1	Educational component 1 Faculty -catalog	4	credit
PS2	Educational component 2 Faculty-catalog	4	credit
PS3	Educational component 3 Faculty-catalog	4	credit
PS4	Educational component 4 Faculty-catalog	4	credit
PS5	Educational component 5 Faculty-catalog	4	credit
PS6	Educational component 6 Faculty-catalog	4	credit
PS7	Educational component 7 Faculty-catalog	4	credit
PS8	Educational component 8 Faculty-catalog	4	credit
PS9	Educational component 9 Faculty-catalog	4	credit
PS10	Educational component 10 Faculty-catalog	4	credit
PS11	Educational component 11 Faculty-catalog	4	credit
PS12	Educational component 12 Faculty-catalog	4	credit
PS13	Educational component 13 Faculty-catalog	4	credit
PS14	Educational component 14 Faculty-catalog	4	credit
The total amount of required component:		180 credit	
The total amount of sample components:		60 credit	
The amount of educational components that provide the acquisition competencies defined by the DHE:		144,5 credit	
<b>TOTAL VOLUME OF THE EDUCATIONAL PROGRAM</b>		<b>240 credit</b>	

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



### 4. HIGHER EDUCATION CERTIFICATION FORM

Certification of applicants for higher education in the educational program "Instrument systems of engineering design" specialty 131 Applied Mechanics is carried out in the form of defense of qualifying work and ends with the issuance of a standard document on awarding him a bachelor's degree with a qualification: Bachelor of Applied Mechanics. Certification is carried out openly and publicly. Qualification work is checked for plagiarism and after defense is placed in the repository of University Library for free access.

## 5. MATRIX OF CONFORMITY OF SOFTWARE COMPETENCIES TO THE COMPONENTS OF THE EDUCATIONAL PROGRAM

	GE1	GE2	GE3	GE4	GE5	GE6	GE7	GE8	GE9	PE1	PE2	PE3	PE4	PE5	PE6	PE7	PE8	PE9	PE10	PE11	PE12	PE13	PE14	PE15	PE16	PE17	PE18	PE19	PE20	PE21	PE22	PE23	PE24			
GK1							x			x	x																									
GK2																																		x	x	
GK3																																		x	x	
GK4																																		x	x	
GK5								x																										x	x	
GK6							x																											x	x	
GK7							x																													
GK8				x					x																											
GK9	x																			x																
GK10						x																														
GK11							x																													
GK12																																			x	
GK13																																			x	
GK14																																				
GK15		x	x				x																												x	
PC1										x	x	x		x		x	x	x			x	x	x		x	x	x									
PC2																					x	x							x	x						
PC3					x																									x	x					
PC4													x																x	x				x	x	
PC5																	x					x	x			x	x									
PC6																								x												
PC7													x		x														x	x						
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PC16																																			x	
PC17																																		x	x	x

