

**«... one of the largest
scientific and educational
divisions of
the Igor Sikorsky KPI,
provides high-quality training
of engineers since 1898...»**



INFORMATION PACKAGE

EDUCATIONAL AND RESEARCH INSTITUTE OF MECHANICAL ENGINEERING

Kyiv, 2022

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***** Information is current as for the 2022/2023 academic year. In the next academic year, there may be minor changes in the list of specialties and educational programs.**



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1. COMMON DESCRIPTION OF THE INSTITUTE

The Educational and Research Institute of Mechanical Engineering (IME) is one of the largest scientific and educational divisions of the Igor Sikorsky KPI. IME provides high-quality training for engineers since 1898. Today, high-level training is provided by the qualified staff of professors and teachers, the modern material and technical base of the departments, and the use of computer-aided design systems. Institute consists of 8 specialized departments, a branch research laboratory, two teaching and research laboratories, the certification body of engineering products and quality systems, research and test center "Reliability"



Studying at the **IME**, one can simultaneously obtain an additional degree in finance and economics or jurisprudence at the Igor Sikorsky KPI. The institute has three specialized councils for the certification of doctoral theses.

IME allows graduates to have internships and find jobs in leading Ukrainian and foreign companies such as SE Antonov, Hydrosila Group, Nibulon, Boeing, HAAS (USA), Airbus (France), Delcam (United Kingdom), Festo (Austria), Heidenhain, Rexroth Bosch Group (Germany) and others.

2. EDUCATIONAL PROGRAMS

Levels of higher education. Training of students at the **IME** is carried out at three levels of higher education.

At the first level (Bachelor's course, I-IV academic years) students acquire fundamental knowledge in physics, mathematics, mechanics, computing, informatics, and special disciplines. During the fourth year, they prepare and defend the bachelor's thesis and acquire a Bachelor's degree.

At the second level, (Master's course, I-II academic years) students acquire relevant professional skills including laboratory practice. Applicants prepare to defend a master's thesis and acquire a Master's degree

The third educational-scientific level is postgraduate studies, I-IV academic years. Applicants defend their dissertations and they are awarded the educational qualification of Doctor of Philosophy (PhPh.D).

Terms of training: Bachelor – 4 years; Master (education-professional program) – 1.5 years; Master (education-scientific program) – 2 years; PhPh.D. 4 years.



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3. STRUCTURE

The Institute of Mechanical Engineering consists of 5 graduating departments, namely:

1. Department of Dynamics and Strength of Machines and Strength of Materials;
2. Department of Manufacturing Engineering;
3. Department of Aircraft Manufacturing Technologies;
4. Department of Machine Design;
5. Applied Fluid Mechanics and Mechatronics Department, as well as:

- Joint Ukrainian-German Center of Mechanical Engineering;
- Educational and Scientific Interdepartmental Center for Dual Education "Progrestech-Ukraine";
- Scientific-Research (Experimental) Laboratory of Measurement Technology;
- Research and Testing Center "Reliability";
- HAAS Training Center;
- Educational and Scientific Laboratory of Computer Technology.

1. Department of Dynamics and Strength of Machines and Strength of Materials provides training under the following Educational Programs:

Specialty	Educational Program	Levels of higher education		
		First	Second	Third
131 Applied Mechanics	Dynamics and Strength of Machines	Bachelor EPP	Master EPP	— —
	Applied Mechanics	—	Master ESP	PhD

Comment: EPP – Educational-Professional Program
ESP – Educational-Scientific Program

The educational program "Dynamics and Strength of Machines" received international accreditation and is recognized as corresponding to the requirements of the European programs of engineering education.



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Faculty graduates get in-depth knowledge of mathematics, physics, the theory of elasticity, ductility, mechanical vibrations, and numerical calculation methods for strength, durability, and reliability of materials and components with the use of a PC. Students acquire skills to work with unique equipment, use modern systems of computer mathematics (Mathcad, Matlab, Maple) and graphics (KOMPAS 3D, Solidworks, AutoCAD), computer-aided design of machines and calculations in engineering, computer software engineering projects (CAD/CAM/CAE systems) (Autodesk Inventor, FEMAP, ANSYS, MSC.ABACUS, CATIA, etc.) and macroeconomics.

To reflect contemporary issues facing machine-building enterprises, a new specialization Project Management of Mechanical Engineering was set up in the Department, which provides in-depth training in economics.

2. Department of Manufacturing Engineering trains high-quality specialists under the following Educational Programs:

Specialty	Educational Program	Levels of higher education		
		First	Second	Third
131 Applied Mechanics	Manufacturing Engineering	Bachelor EPP	Master EPP	–
	Applied Mechanics	–	Master ESP	PhD

Comment: EPP – Educational-Professional Program

ESP – Educational-Scientific Program

Specialization mastered by students offers modern methods of production of mechanical engineering products with extensive use of CNC machine tools, flexible manufacturing systems, industrial robots, computer-aided design and manufacturing systems, modern methods and means of quality control; practical skills of the production and HR management, knowledge of the laws of the market economy, marketing, and management.



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The specialization provides in-depth computer training in the field of PLM technologies, which greatly enhances employment opportunities. According to individual



plans, professionals are trained who are working successfully in the fields of the aerospace industry, manufacturing with the use of high-precision technology, machine tool building, instrument making, motor vehicle industry, aircraft industry, and electronics.

Educational and Training Center "Igor Sikorsky KPI - HAAS", which is equipped with the modern CNC processing centers from the world-famed company HAAS (USA) operates at the department.

3. Department of Aircraft Manufacturing Technologies trains specialists under the following Educational Programs:

Specialty	Educational Program	Levels of higher education		
		First	Second	Third
131 Applied Mechanics	Aircraft Manufacturing Technologies	Bachelor EPP	Master EPP	–
	Applied Mechanics	–	–	PhD

Comment: EPP – Educational-Professional Program

ESP – Educational-Scientific Program

Specialists receive fundamental engineering training in comprehensive technologies of



science-intensive machine-building production; design of forging and pressing machines and equipment for the manufacture of construction materials. Knowledge of information technology, international system of quality of mechanical engineering products, organization of production, basics of management, and marketing provide specialists with a stable demand for enterprises of

various forms of ownership.



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4. Department of Machine Design provides training under the following Educational Programs:

Specialty	Educational Program	Levels of higher education		
		First	Second	Third
131 Applied Mechanics	Machine Design	Bachelor EPP	Master EPP	–
	Applied Mechanics	–	–	PhD

Comment: EPP – Educational-Professional Program

ESP – Educational-Scientific Program

The specialization provides training for design engineers in the field of mechanical



engineering and metalworking. Graduates receive advanced training in fundamental engineering construction and machinery manufacturing technology, industrial robots, and other machines; the use of modern methods of searching for technical solutions, methods of theoretical and experimental research of machines; programming on PC, mathematical modeling, the fundamentals of patent and licensing work, technical service and

repair of machinery and control systems; organization of production, the economics, the fundamentals of management and marketing.

Training Center with the programmer's working places was organized based on digital program control from the company Heidenhain (Germany).

5. Applied Fluid Mechanics and Mechatronics Department provide training under the following Educational Programs:

Specialty	Educational Program	Levels of higher education		
		First	Second	Third
131 Applied Mechanics	Automated and Robotic Mechanical Systems	Bachelor EPP	Master EPP	–
	Applied Mechanics	–	–	PhD

Comment: EPP – Educational-Professional Program

ESP – Educational-Scientific Program



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Department graduates are engaged in the development of pneumatic and hydraulic devices used in automatic control machine tool systems, rolling mills, presses, turbine control systems, internal combustion engines, aircraft and spacecraft, shipbuilding and transport equipment, road construction, and agricultural and special equipment.

Targeted training and job placement of specialists is carried out at the department ("IRCOM", "Geofizpribor", ASTC "Antonov", representative offices of companies SMC, HYDAC, FESTO, Carnozzi, Karcher, Rexroth).

The laboratories of the department are equipped with the latest equipment from leading companies: Bosch-Rexroth, Festo, HAWE, Hydrosila GROUP, and others.

The best students undergo an internship in Germany.

Joint Ukrainian-German Center of Mechanical Engineering

The Center's main purpose is to improve the system of postgraduate education, meet the needs of Ukrainian enterprises that use modern technology and knowledge-intensive technologies, and specialists who must have modern experience in the design, manufacture, and operation of machines and automated complexes of machine-building production. In German, know European standards, standardization systems, certification, and product quality management systems, be able to work with German documentation, as well as compile it yourself.

The task of the Center is to conduct research in priority areas of science and technology.

Educational-Research Center for Dual Education "Progrestech-Ukraine" has the following main tasks:

- coordination of the introduction and implementation of the dual form of higher education for graduates of engineering in the field of training in cooperation with LLC "Progrestech-Ukraine", in particular in the specialties: 131 Applied Mechanics, 134 Aerospace, 151 Automation and Computer-Integrated Technologies, 171 Electronics, 172 Telecommunications and Radio Engineering, 173 Avionics;
- joint work in the direction of fundamental and professional training of applicants for higher education to form the appropriate level of competence for future professionals;
- implementation of a set of measures for the professional orientation of higher education seekers and students of Ukraine to promote engineering specialties;
- implementation with the Training and Research Center of Innovative Monitoring of the Quality of Education and LLC "Progrestech-Ukraine" the assessment of residual knowledge in training programs for specialists in the above specialties



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jointly with the Training and Research Center of Innovative Monitoring of the Quality of Education and LLC "Progrestech-Ukraine";

- development of the system of advanced training through an internship of scientific and pedagogical staff of the Igor Sikorsky KPI, as well as through the implementation of training programs for graduates of higher education institutions, engineers with experience, etc. in conjunction with the Institute of Postgraduate Education of the Igor Sikorsky KPI.
- organization of joint events with Progrestech-Ukraine LLC to promote international and European accreditation of engineering programs.

Research (Experimental) Laboratory of Measuring Equipment has the following functions:

- conducting practical classes in academic disciplines following the current curricula;
- improving the quality of the educational process;
- creation of safe working conditions for all participants in the educational process under the requirements of the legislation;
- purchase and maintain devices, equipment, and materials for practical work; carry out metrological certification and verification of control and measuring equipment.

Research and Testing Center “Reliability” has the following main tasks:

- conducting scientific and certification research in priority areas of science and technology and implementing their results in close cooperation with the training of specialists;
- international cooperation in the framework of direct relations and separate contacts with foreign partners;
- Conduct certification tests of products manufactured in Ukraine and abroad, following the accreditation certificate registered in the Register of the National Accreditation Agency of Ukraine.

The HAAS Training Center provides the implementation of modern methods of technological preparation for the production of machine parts on CNC machines with the implementation of the following training algorithm: the study of the theoretical foundations of programming using HAAS software, integrated CAD/CAV testing systems, creating control programs on CNC machines of HAAS in the process of manufacturing the designed parts.

Educational and Scientific Laboratory of Computer Technology has the following tasks:

- promoting the quality of training of specialists in mechanical engineering;
- conducting laboratory and practical classes in disciplines at a high scientific, methodological, and technical level under current working curricula and guidelines;



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- ensuring the use of computer technology and teaching aids for teachers and students;
- control over the timely updating of the information found, replenishment of the electronic library with textbooks, guidelines, and tests;
- organization of extracurricular, independent work of full-time and part-time students, thanks to which students' creative research abilities develop;
- providing individual work of teachers, graduate students, and students, consultations of research, and teaching staff.

4. TRAINING AND LABORATORY BASE

The training-laboratory base of **IME** consists of:

- Educational and scientific Laboratories of Computer Engineering;
- Laboratory of Measurement Technology;
- Laboratory of Durability and Reliability;
- Laboratory of Polymer and Composite Materials;
- Training and Research Laboratory of Mathematical Modeling Methods in Mechanics of Solid Deformable Body;
- Science and testing Center "Reliability";
- Training Center "Igor Sikorsky KPI - HAAS";
- Research Center of Special Technology;
- Training and Scientific Center "Igor Sikorsky KPI –FESTO";
- Joint Training Center "Igor Sikorsky KPI - Progresstech-Ukraine";
- Joint Center of CAD/CAM technologies Igor Sikorsky KPI- Delcam, United Kingdom.

The best senior students have the opportunity to get "FESTO-didactics" firm scholarship and undergo monthly training at the enterprises of the company in Austria

In the Educational and Training Center, "Igor Sikorsky KPI – HAAS" students are trained to use the advanced technology of machine-building production: beginning from the computer development of control programs for CNC machines with the help of modern integrated CAD/CAM systems and finishing by the production of parts with the use of lathe and milling centers of HAAS company (USA). Manufacturers are trained and retrained in the Center too. A Center for postgraduate education was created at the faculty.

Training Center "Igor Sikorsky KPI - FESTO" was established at the Applied Fluid Aeromechanics and Mechatronics Department to improve the level of specialists' training, jointly with the Austro-German company FESTO. The Center is equipped with the most advanced technique and training stands. Students can get acquainted with the modern



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methods of production and testing of systems and components of hydro- and pneumoautomatic, CAD methods.

The Joint Training Center "Igor Sikorsky KPI - Progresstech-Ukraine"; which was opened based on the Mechanical-Engineering Institute, provides training for mechanical engineers for work in the aviation industry and advanced training for specialists working in the aviation industry.

5. RESEARCH ACTIVITY

The main directions of the *Department of Dynamics and Strength of Machines and Strength of Materials*:

- development of models and failure criteria of structural elements under complex thermal loads because of damages;
- development of equations of the theory of plasticity and creeping under complex loading processes;
- development of the theory of nonlinear oscillations;
- development of numerical methods for solving boundary value problems of the mechanics of deformable bodies;
- development of mathematical models of the plasticity of anisotropic media under complex stress states;
- development of methods of calculation of the bearing capacity of structural elements of the composite and polymer materials.

Department of Aircraft Manufacturing Technology performs research and development in the following areas:

- creation of information technology for the implementation of intensive plastic deformation of materials in the cold and the determination of optimal process parameters;
- improvement of existing and development of new low-waste and waste-free high-performance manufacturing processes of cold forming of precision products made of ductile and low-ductile metal;
- computer-aided design stamping tooling for various operations of cold forging.



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Applied Fluid Aeromechanics and Mechatronics Department perform research and development in the following areas:

- fluid dynamics and heat transfer in non-Newtonian fluids and the processes of their treatment;
- creation of computer-aided design systems of electrohydraulic, pneumatic, and electromagnetic drives of aircraft, industrial robots, road construction, agricultural and other machines;
- the creation of new structures of volume hydraulic and pneumatic drives and hydro pneumatic machinery control systems;
- development of regulatory and hydropneumatic overlapping bodies with improved characteristics;
- creation of a complex piezohydropneumatic automation equipment;
- simulation modeling of hydropneumatic tools and systems;
- research of fluid and gas-dynamic processes in energy-converting machinery and aggregates.

Department of Manufacturing Engineering carries out scientific research in the following areas:

- control of cutting processes on the CNC machines;
- optimization of machining processes;
- automation of control programs for CNC machine tools;
- creating macro routines for CAD/CAM systems;
- methods of complex surface processing of machine parts;
- automation of machine assembly in mechanical engineering and instrument making;
- technology and software for the investigation of arbitrary technical and technological systems.

Research at the **Department of Machine Design** is focused on:

- development of design theory and practical implementation of the multi-axis metalworking equipment, including machines of parallel kinematics based on the use of mechatronic drive systems;
- mathematical modeling of the mechanic processes and systems;
- creation of automated machines, CNC machines, machining complexes, and mechanisms on a modular principle;



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- research on the dynamics of machines drives, industrial robots, and technological systems;
- development of the theoretical foundations of the design of machine tools, in particular lathes, CNC lathes, and modules, as well as industrial robots and other machines, creating a computer-aided design;
- creation of devices for automation and metal-processing equipment: machine tool modules, automatic machining lines, robotic systems, and flexible manufacturing systems;
- theoretical and experimental research of tools and other machines to determine their static and dynamic characteristics, mathematical modeling of machines and their components;
- development and research of high-speed, multi-functional mechanisms of manipulation and clamping of billets for metal cutting machines.

6. INTERNATIONAL PROJECTS AND COLLABORATION

IME has 24 active agreements on joint scientific and educational-methodical activities with the following foreign institutions:

- Technical University of Gabrovo (Bulgaria);
- Otto-von-Guericke University Magdeburg (Germany);
- Institute for Machine Tools at the University of Stuttgart (Germany);
- Lublin Polytechnic University (Poland);
- Czestochowa University of Technology (Poland)
- University of Okayama (Japan)
- Faculty of Mechanical Engineering, University of Belgrade (Serbia)
- Zhejiang University (China)
- Tallinn Technical University (Republic of Estonia)
- Warsaw University of Technology (Poland)
- Wroclaw Technical University (Poland)
- University of Petrosani (Romania)
- University Politehnica of Bucharest (Romania)
- The Fluminense Federal University (Brazil)
- Texas Institute of Science (USA)
- University of Toledo (USA)
- University of Warmia and Mazury in Olsztyn (Poland)



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- Al-Balqa' Applied University (Jordan)
- Georgian Technical University (Georgia).
- Delcam Plc (Great Britain),
- PTC Inc. (USA),
- Autodesk Inc. (USA).

IME maintains permanent relations with higher technical educational institutions of the CIS countries within the framework of the exchange of scientific and technical, educational, and methodological information, and joint participation in international scientific conferences and seminars.

The following international structures operate in the **IME**:

- Center Igor Sikorsky KPI - HAAS;
- Joint Faculty of Mechanical Engineering of Igor Sikorsky KPI and Otto-von-Guericke University of Magdeburg;
- Center Igor Sikorsky KPI - Progrestech Ukraine (Boeing, USA);
- CAD / CAM Joint Center for Technologies. Igor Sikorsky KPI - Delcam, UK;
- Joint Authorized Training Center. Igor Sikorsky KPI - Autodesk, USA



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