

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



INFORMATION PACKAGE

INSTITUTE OF MECHANICAL ENGINEERING

Kyiv, 2016

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*** *The information is current as for 2016/2017 academic year. In the next academic year, there may be minor changes in the list of training directions, specialties, and specializations.*



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1. COMMON DESCRIPTION AND THE STRUCTURE OF FACULTY

Institute of Mechanical Engineering (IME) is one of the largest scientific and



educational divisions of the Igor Sikorsky KPI. IME provides high-quality training of engineers since 1898. Today, a high-level training is provided by the qualified staff of professors and teachers, modern material and technical base of the departments, use of computer-aided design systems. Institute consists of 8 specialized departments, branch research laboratory, two

teaching and research laboratories, 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 in jurisprudence at the Igor Sikorsky KPI. The institute has three specialized councils for certification of theses for the degree of doctor and candidate of technical sciences.

Structure

**On February 4, 2016
in Institute of Mechanical
Engineering was opened a new
Joint Educational and
Scientific Center of the Igor
Sikorsky KPI and companies
"Boeing" and "Progresstech-
Ukraine"**

1. Department of Dynamics, Strength of Machines and Resistance of Materials provides training of specialists with a degree in "Applied Mechanics" (specializations "Dynamics and Strength of Machines", "Information Systems and Technologies in Machine Building") in field of computer and experimental solving of actual applied problems of strength in biomechanics, aviation, motor vehicle industry, shipbuilding,

energetics, rocket production and astronautics.

Faculty graduates get in-depth knowledge of mathematics, physics, theory of elasticity, ductility, mechanical vibrations, numerical calculation methods for strength, durability and reliability of materials and components with the use of PC. Students acquire skills to work with the unique equipment, use of 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.



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

Center of CAD/CAM technologies operates at the department since 2007, jointly with the company Delcam plc (UK)

2. Department of Integrated Manufacturing Engineering trains specialists with a degree in "Industrial Engineering" (specializations "Instrumental Systems and Formative Technologies") in the field of design, the production process of special instruments, tooling and equipment for creation and testing of

instruments of all types and constructions.

Specialization Instrumental Systems and Formative Technologies has the main features of specialists in computer systems, programmers, production managers, as well as design and process engineers, capable of implementing a virtual engineering and possess the critical technologies of forming, explore and set limits of these technologies.

Specialization Technical Design combines the basics of training of designer and developer of technical objects with the relevant technological and artistic activities.

3. Department of Mechanics of Materials Plasticity and Resource-Saving Processes prepares specialists with a degree in "Applied Mechanics" (specializations "Equipment and Technologies for Plastic Forming of Constructions in Machine-Building", "Technologies and Constructions of Products from Nanostructured and Composite Materials", and "Technology and Constructions of Products for Special Purposes").



Students obtain fundamental training in complex technology of high-tech machine-building production and designing of compression-type machines and equipment for the manufacture of construction materials. Knowledge of information technology, international quality system for engineering products, an organization of production, management, and marketing provide a strong demand for that kind of professionals by enterprises of different forms of ownership. The department has a specializations Technology and Design of Products for Special Purposes, Creation of Products from Nanostructured and Composite Materials



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4. Department of Applied Aerohydromechanics and Mechatronics

trains high-quality specialists with a degree in "Applied Mechanics" (specialization "Hydraulic and Pneumatic Machines and Drive Systems" and "Mechatronic Systems in Machine Building") for all the branches of engineering (mechanical engineering, aviation, oil and gas industry, industrial automation, motor-vehicle industry, medicine).

Laboratories of department are equipped with the latest technics of leading firms: Bosch-Rexroth, Festo, HAWE, etc. Center "KPI-FEST" and affiliated company Rexroth participate in the educational process. The best students, provided knowledge of foreign languages, are trained in Germany

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

5. Department of Manufacturing Engineering

trains high-quality specialists with a degree in "Applied Mechanics" (specializations "Technology of Manufacturing Engineering" and "Manufacturing of Parts and Assembling of Aircraft Units").



"Technology of Manufacturing Engineering" offers a 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.

Specialization "Manufacturing of Parts and Assembling of Aircraft Units" provides an 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 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.



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6. Department of Applied Mechanics trains high-quality masters in "Applied Mechanics" (specialization "Engineering of Logistic Systems") in an area of development and optimization of lifting-and-shifting machines, transport and storage systems, automated production systems based on extensive use of computer systems design and engineering, transportation management, warehousing and production facilities, planning and quality control.

Experts of this profile obtained fundamental engineering training and skills in the design and calculations of machines and mechanisms for lifting and transport vehicles, their testing and diagnostics, optimization based on the use of logistics methods.

7. Department of Laser Technology and Material Science trains highly qualified specialists with a degree in "Applied Mechanics" (specialization masters in "Laser Techniques and Physical-Technical Materials Processing").



Training opportunities of the department include the modern industrial laser technological complexes, unique equipment for other non-traditional materials processing techniques, as well as various tools for traditional processing technology, well-equipped laboratories for materials science and classrooms with modern personal computers.

The curriculum provides the opportunity to gain fundamental knowledge in the field of engineering, organization of production and technology of mechanical engineering with an emphasis on a variety of non-conventional materials processing methods.

8. Department of Design of Machine Tools and Machines trains high-quality specialists with a degree in "Industrial Engineering" (specialization "Metal-Cutting Machine Tools and Systems") and "Law" (specialization "Intellectual Property in Machine Building").

Specialty "Metal-Cutting Machine Tools and Systems" provides training of design engineer in the field of mechanical engineering. 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 on the basis of digital program control from company Heidenhain (Germany).



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Specialization "Intellectual Property in Engineering" provides comprehensive training in international patent and licensing activity, international law in the field of intellectual property, the acquisition of intellectual property rights, management of intellectual property rights and their protection.

Scientifically-Methodical Laboratory of Virtual Ways of Training in Engineering Mechanics

The Laboratory was founded in 2001 as a subdivision of Institute of Mechanical Engineering with the purpose of development and implementation in the learning process applied software for practical and laboratory work on the modeling of real processes of metal working software products for the Engineering Mechanics.

Research and Testing Center "Reliability"

consists of 7 laboratories, which operate under the guidance of professors and associate professors of corresponding departments

2. EDUCATIONAL PROGRAMS

Levels of higher education. Training of students at the IME is carried out at several levels of higher education. The first (Bachelor's, I – IV academic years) – the students acquire fundamental knowledge in physics, mathematics, mechanics, computer engineering, and special disciplines. During the IV year, they defend bachelor course works and receive qualification degree, Bachelor.

At the second level (Magistracy, V – VI academic years) training is carried out according to the Master program. Students are trained and acquire relevant skills including laboratory practice.

Additionally, students have the opportunity to continue their education in a graduate course, and then in a doctoral candidacy of the University.

Terms of specialists training: Bachelor (b) – 4 years; Master (m) – 2 years (standard terms of training at Bachelor course and Magistracy), Graduate course / Doctoral candidacy – 3 years (4 years by the correspondence study).

Training of specialists is carried out on the full-time and correspondence forms of education.



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Areas and specialties of students' training:

Doctor of Sciences

- Mechanics of Deformed Solid Body
- Dynamics and Strength of Machines
- Processes and Machines for Pressure Shaping
- Machining Processes, Tools, and Instruments
- Manufacturing Engineering
- Science of Machines
- Welding, Related Processes, and Technologies
- Physical-Technical Materials Processing

Doctor of Philosophy (Ph.D.)

Magistracy

- Intellectual Property in Engineering
- Technology and Constructions of Products for Special Purposes
- Technologies in Machine Building
- Laser Techniques and Physical-Technical Materials Processing
- Dynamics and Strength of Machines
- Equipment and Technologies for Plastic Forming of Constructions in Machine-Building
- Engineering of Logistic Systems
- Information Systems and Technologies in Machine Building

Bachelor's course

- Manufacturing of Parts and Assembling of Aircraft Units
- Technologies and Constructions of Products from Nanostructured and Composite Materials
- Mechatronic Systems in Machine Building
- Hydraulic and Pneumatic Machines and Drive Systems
- Engineering Design
- Instrumental Systems and Formative Technologies
- Metal-Cutting Machine Tools and Systems



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3. TRAINING AND LABORATORY BASE

Training-laboratory base of IME consists of educational and scientific Laboratories of Computer Engineering, Laboratory of Measurement Technology, Laboratories of Durability and Reliability, Laboratory of Polymer and Composite Materials, teaching and research Laboratory of Mathematical Modeling Methods in Mechanics of Solid Deformable Body, science and testing Center "Reliability", Training Center Igor Sikorsky KPI - "HAAS", the 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. Center of postgraduate education was created at the faculty.

To improve the level of specialists' training, Training Center "Igor Sikorsky KPI - FESTO" was established at the [Department of Applied Aerohydromechanics and Mechatronics](#) jointly with the Austro-German company FESTO. Center is equipped with the most advanced technique and training stands. Students can get acquainted with the modern methods of production and testing of systems and components of hydroautomatics, CAD methods.

4. RESEARCH ACTIVITY

The main directions of scientific research of [Department of Dynamics, Strength of Machines and Resistance of Materials](#):

- development of models and failure criteria of structural elements under complex thermal-loads in view 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 state;
- development of methods of calculation of the bearing capacity of structural elements of the composite and polymer materials.

Department of Integrated Technologies Engineering carry out research in the following areas:

- development of the theory of the formation of surfaces and design of various types of tools, the creation of new innovative constructions;
- formative computer technology and solid state design of tools and formed parts;
- mathematical modeling of tools working and the optimization of structures and operating conditions of the instrument using the methods of self-organization.

Department of Mechanics of Materials Plasticity and Resource-Saving Processes performs research and development in the following areas:

- creation of information technology for 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.

Department of Applied Aerohydromechanics and Mechatronics performs research and development in the following areas:

- fluid dynamics and heat transfer in non-Newtonian fluids and the processes of their treating;
- creation of computer-aided design systems of electrohydraulic, pneumatic, electromagnetic drives of aircraft, industrial robots, road construction, agricultural and other machines;
- the creation of new structures of volume hydraulic and pneumatic drives and hydropneumatic 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.



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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 surfaces processing of machine parts;
- automation of machine assembly in mechanical engineering and instrument making;
- technology and software for investigation of arbitrary technical and technological systems.

Department of Applied Mechanics performs scientific research in the following areas:

- development of structures damping rollers, charging cable sections and ponds, for conveyor belts width 1200-1400 mm, which reduces the dynamic forces in the conveyor elements and increase the service life of rollers and belts;
- development and manufacturing application of steeply inclined conveyor, which can save production areas as well as create preconditions for the creation of warehouses for processing of intermediate products and, as a consequence, decrease downtime of processing enterprises;
- increasing the reliability and energy saving of transporting machinery with a chain drive element, such as escalators and moving walkways;
- optimization of kinematic, power and energy parameters of passenger lifts.

Research at the **Department of Machine Tools** are focused at:

- 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;
- research of 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, flexible manufacturing systems;



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- 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 workpieces of machine tools.

5. 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);
- The 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)
- Togliatti State University (Russia)
- Zhejiang University (China)
- P.O. Sukhoy Homiel State Technical University (Belarus)
- Belarusian-Russian University (Mogilev, Belarus)
- Tallinn Technical University (Republic of Estonia)
- Warsaw University of Technology (Poland)
- Wroclaw Technical University (Poland)
- University of Petrosani (Romania)
- University Politehnica of Bucharest (Romania)
- Saint-Petersburg State University of Engineering and Economics (Russia)
- The Fluminense Federal University (Brazil)
- Texas Institute of Science (USA)
- University of Toledo (USA)
- Moscow State University of Mechanical Engineering MAMI (Russia)
- University of Warmia and Mazury in Olsztyn (Poland)
- Al-Balqa' Applied University (Jordan)
- Georgian Technical University (Georgia).



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Department of Integrated Technologies Engineering established academic and scientific ties with many leading research centers and educational institutions of Ukraine, with foreign universities and companies from Germany, Romania, China, and Poland.

Department of Laser Technology and Material Science has good scientific ties in the academic and research sector with many famous universities and laboratories around the world. Cooperation agreement is signed with the Ohio State University (USA), Osaka University, Okayama University (Japan), the University of Jena (Germany), McMaster University (Canada), Bauman State Moscow Technical University (Russia) and others. The professors and researchers collaborate with CIRP (The International Academy for Production Engineering), LIA (Laser Institute of America), the IEEE (Institute of Electrical and Electronic Engineers) and other international professional funds.

The joint Ukrainian-German Faculty of Mechanical Engineering of the Igor Sikorsky KPI and the Otto-von-Guericke University Magdeburg was established in 2002, based on the IME, Welding Faculty, and Faculty of Physical Engineering of the Igor Sikorsky KPI, which provides training for all mechanical engineering disciplines. After defending his master's thesis in Germany, students receive a German master's state-recognized degree, and then after defending in Ukraine - Ukrainian master's state-recognized degree.



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