"...development and maintenance of modern instruments and systems: the measuring equipment of onboard complexes, diagnostic complexes of medical and general purposes, controlling devices for energy-saving systems..."



INFORMATION PACKAGE

FACULTY OF INSTRUMENTATION ENGINEERING

Kyiv, 2020

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*** Information is current as for the 2020/2021 academic year. In the next academic year, there may be minor changes in the list of training specialties and educational programs.



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1. COMMON DESCRIPTION AND STRUCTURE OF FACULTY

Faculty of Instrumentation Engineering (FIE) provides training in the development and maintenance of modern instruments and systems for various



applications: measuring equipment of onboard complexes, diagnostic complexes for medical and general purposes, controlling devices for energy-savin g systems.

Students acquire extensive knowledge and skills in the use of modern methods of construction of high-precision devices with the

use of a microprocessor and computer technology, computer-aided design, and computer graphics.

FIE graduates work at instrument-making enterprises of aviation and space profile, enterprises on the introduction of energy-saving technologies, on development and introduction of modern medical diagnostic, training and medical complexes, transport and printing enterprises.

Structure: The Faculty of Instrumentation Engineering includes six departments.

1. Department of Instrument Making trains specialists with a degree in Automation



and Computer-Integrated Technologies" (educational program /specialization "Computer-Integrated Technologies for Instruments Design").

The purpose of the training course is to acquire new information technology by future professionals, their studying of modern computer-aided design (CAD, CAE, CAM, CAD "Catia", etc.), as well as obtaining the necessary knowledge to develop computer-measuring

complexes (including the energy-saving industry).



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2. Department of Devices Production trains specialists with a degree in

"Automation and Computer-integrated Technologies" (educational program/specialization "Computer-integrated Technologies for Instrument Production").

Educational program "Computerintegrated Technologies for Instrument Production" is the latest trend of high-tech, which uses the latest advances in the field of



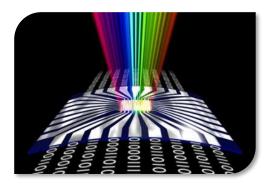
computer and information tools, artificial intelligence, control theory, microprocessor technology, electronics and automation elements of design and manufacturing processes.

3. Department of Orientation and Navigation Instruments and Systems trains specialists with a degree in "Automation and Computer-integrated Technologies" (educational program/specialization "Computer-integrated Technologies and Systems for Navigation and Control."

The main areas of training include the development and implementation of computer technology in the design of orientation, navigation and traffic management, technical and medical diagnostic systems; design of devices and systems for measuring and recording the parameters of motion of physical and biological objects.

During the course, students acquire knowledge of computer technologies, systems CAE-CAD (AutoCAD, SolidWorks, Nastran, Compass), programs for the development of electronic circuits (MicroCAP, LabVIEW), programming languages (Delphi, C ++), systems of mathematical modeling (Matlab, MathCAD), Web-based design. The department has its computer center and modern laboratories in the core disciplines.

4. Department of Optical and Optoelectronic Instruments trains specialists with



a degree in "Automation and Computer-Integrated Technologies" (educational program "Computer-integrated Optoelectronic Systems and Technologies").

Studying in the Igor Sikorsky KPI is a unique possibility of obtaining the state diploma of an educational institution of the highest level of accreditation in the field of applied engineering of

optical technologies in Ukraine.

The Department opened the French-Ukrainian master's program with a double diploma of the Igor Sikorsky KPI in the field "Photonics and Optoinformatics". There is also a specialty "Physics. Photonics and optical engineering" opened in cooperation with



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the University of Le-Mann. Students participating in the program receive financial support from the Embassy of France in Ukraine.

5. Department of Non-Destructive Instruments and Systems

trains specialists with a degree in "Automation and Computer-integrated Technologies" (educational program/specialization "Computer-integrated Technologies and Robotic and automated Systems of Nondestructive Control and Diagnostics").

The main direction of educational work is the training of self-sufficient specialists in the design and operation of

systems of non-destructive control of construction materials and technical diagnostics of machinery. At the same time, graduates of the Department receive the necessary training to work in the field of medical engineering.

6. Department of Information and Measuring Technologies trains specialists with a degree in "Metrology and Information Measuring Technique" (educational



programs/specializations "Metrology and Measuring Technique", "Information Measuring Technologies of Ecological Safety" and "Information-Measuring Technologies and Systems").

Bachelor's and Master's degrees at the Department of Information and Measurement Technologies are aimed at performing professional research, development, pedagogical, management

and innovation works in the field of metrology: development of modern computerized measuring instruments; quality control and evaluation, standardization, certification; development, testing, operation of computer systems and their provision (methodological, algorithmic, software) for obtaining information about the properties and condition of the object; planning and conducting scientific and technical experiments; testing and research of samples of new equipment and new technologies, management of projects and programs in the field of material (intangible) production, technical expertise; control, diagnosis and prediction of the state of technical, biological and natural objects; development, implementation of measurement and information technologies for processing of the information received during measurements.

The basis of the professional component of the curriculum of the educational program "Information Measuring Technologies of Ecological Safety" are such disciplines as analytical ecological devices, ecological monitoring systems, measuring instruments of environmental parameters, radiation measuring devices, food quality control devices,



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information technologies in ecology, technological ecological monitoring, ecological safety, ecological audit, an ecology of sustainable development, metrological support of analytical devices, logistics of instrument making.

The training course in the educational program "Information Measurement Technologies and Systems") involves the study of programming, computer technology, electronics, and information measurement technologies for the development and operation of computer measurement systems, research, and comprehensive testing of complex objects.

2. EDUCATIONAL PROGRAMS

Levels of higher education. The training of students in FIE is carried out in three levels of higher education. At the first (bachelor) level of higher education - students acquire basic knowledge in physics, mathematics, mechanics, computer engineering, computer science, and special disciplines. In the fourth year, they defend the bachelor's qualification work and receive a bachelor's degree.

At the second (master's) level of higher education, the training is carried out according to educational-professional and educational-scientific training programs, where students receive special training and acquire relevant practical skills in the laboratories of the faculty and at leading enterprises of the industry. Upon completion of the study, students defend the master's qualification work and receive a master's degree.

At the third (educational-scientific) level of higher education, higher education students receive knowledge, skills, and other competencies sufficient to produce new ideas, solve complex problems in the field of professional and/or research-innovation activity, master the methodology of scientific and pedagogical activities, as well as conducting their scientific research, the results of which have scientific novelty, theoretical and practical significance. The degree of Ph.D. is awarded by a specialized academic council of a higher education institution as a result of the successful completion of the corresponding higher education program by the applicant and public defense of the thesis in the specialized academic council.

Terms of training: Bachelor (b) - 3 years 10 months; Master's degree (m) - 1 year 4 months for the educational and professional training program, 1 year 9 months for the educational and scientific training program, postgraduate 4 years. Specialists are trained in full-time and part-time forms of study.

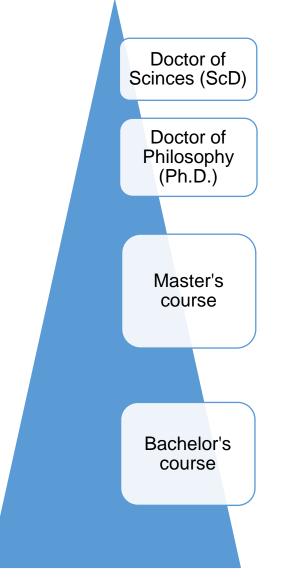


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Specialties and educational programs/specializations:



<u>Automation</u> and Computer-Integrated Technologies

<u>Metrology, Informative and Measuring Equipment</u>

Automation and Computer-Integrated Technologies

- Computer-Integrated Technology for Instruments Design
- Computer-Integrated Technology for Instruments Production
- Computer-Integrated Technologies and Systems for Navigation and Control
- Robotic and Automated Systems of Non-Destructive Control and Diagnostics
- Computer-Integrated Optoelectronic Systems and Technologies

Metrology, Informative and Measuring Equipment

- Metrology and Information Measuring Technique
- Information Measuring Technologies of Ecological Safety
- Information Measuring Technologies and Systems

3. TRAINING AND LABORATORY BASE

Department of Instrument Making has five specialized training laboratories:

- Laboratory of Microprocessor Engineering and Computer Measurement Systems;
- Laboratory of Computer Technology;
- Laboratory of Conversion Devices;
- Laboratory of Elements of devices and tools for measuring motion parameters;



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- Laboratory of Flow measuring instruments;
- Laboratory of Measuring equipment in the energy-saving systems.

Students study:

- MatLab & Simulink modeling of mathematical models and processes;
- MathCAD mathematical calculations:
- LabVIEW a development environment and platform for executing programs created in the graphical programming language "G";
- C ++ programming language;
- SolidWorks CAD software system for automation of industrial enterprise operations at the stages of design and technological preparation of production;



 CATIA - a computer-aided design system for three-dimensional modeling and realtime teamwork.

Department of Instrumentation Design and Engineering. Students have at their disposal well-equipped training department laboratories of

- Physical Principals of Material Processing;
- The technology of Device Components;
- Testing of Devices;
- Automation of Industrial Processes;
- Flexible Manufacturing Systems and Industrial Complexes;
- Optoelectronic Methods of Monitoring and Measurement;
- Biometrics and Medical Devices;
- Computing Technique.

At the **Department of Instruments and Systems of Orientation and Navigation**, there are four training laboratories of

- Computer Technologies (PC training class);
- Design Elements and Units of Devices and Systems;
- Gyroscopic and Navigation Equipment and Systems;
- Automatic Control Systems of Mobile Units.



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Department of Optical and Opticalelectronic Instruments is equipped with the following laboratories and classrooms:

- "Wave Optics" Laboratory.
- "Applied Optics" Laboratory.
- "Optoelectronic Devices" Laboratory.
- "Optical and Optoelectronic System Testing" Laboratory.
- "Optical Measurements" Laboratory.

In the lab course "Optical measurements" a research group of photometric studies operates, where the research work is carried out by students of the Department on the subject of "Methods, means and metrological assurance of measuring energy characteristics of multielement detectors and devices on their basis".

During the teaching process are used applications, which are specially designed at the Department:

"Aber" - for computer-aided design of optical systems;

"Ray" - for aberration analysis of optical systems;

"VARIO" - for calculating the two-dimensional and three-lens, mirror and mirror-lens optical systems of zoom with optical image plane shift compensation;

"Condenser" - for the calculation of one-, two- and three-lens condenser;

"ASOC" - for aberration synthesis one-, two- and three-lens glued and unglued optical components;

"Radius" - to find the default values of the radii of the spherical surfaces of optical components;

"Tele" - for calculating the dimensional telephoto lenses, etc.

Software and technical support of the educational process at the **Department of Non-Destructive Testing Instruments and Systems.** The students acquire knowledge and skills to work with different software products for better designing devices and non-destructive testing systems.

Students study:

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- MatLab&Simulink simulation of mathematical models and processes;
- MathCAD mathematical calculations;
- LabVIEW development environment and platform for running programs created in the graphical programming language "G";
- PCAD development of electrical circuit boards for automated systems;





- C++ programming language;
- FemLab modeling of thermal and electromagnetic processes.



The study of subjects takes place in laboratories:

- Laboratory of Informatics and Computer Science;
- · Laboratory of NC solenoid and electronics;
- · Laboratory of Optical NDT methods;
- Laboratory of Thermal NDT methods;
- Laboratory of Acoustic NDT methods.

At present, the **Department of Information and Measurement Technique** has state-of-the-art training and research computer labs connected by two local Ethernet networks with Internet access:

- Research Laboratory of Measuring Converters;
- Training Laboratory of Fundamentals of Metrology and Measurement Engineering;
- Research Laboratory of Automation of Metrological Testing of Experimental Informatics;



- Laboratory of Information Technologies in Distance Learning;
- Research Laboratory of Measurement Systems for Multidimensional Processes and Field Physics;
- Non-electric Measurement Research Laboratory;
- Research Laboratory for Measurement of Electrical and Magnetic Values;
- Training Laboratory for Technical Mechanics and Appliance Design;
- Research Laboratory of Measuring Diagnostic Systems;
- Educational and Research Laboratory of Microprocessor Engineering and IMS Digital Measurement Converters;
- VDSPL Motorola Digital Signal Processor
 Virtual Laboratory certified digital signal
 processing laboratory with the status of
 "Motorola Authorized Semiconductor Sector





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Laboratory for Teaching Students and Professionals in Microprocessors, Microcontrollers, and Digital Signal Processors".

Workplaces in the training laboratories created with the sponsorship of firms:

Motorola

- HC11 / 12 microcontrollers (12 workplaces)
- PowerPC microcontrollers (12 workplaces)
- 68000 microcontrollers (6 workplaces)
- DSP 56000 microcontrollers (8 workplaces)

National Instruments

LabView (10 workplaces): an introduction with LabView; development of virtual devices in the LabView environment; development of information-measuring systems based on virtual devices; study of metrological characteristics of information-measuring systems.

Infopulse

NXP LPC/ARM + Embedded Internet DM9000 (10 workplaces)

Texas Instruments

TMS320C67 13 DSP Starter Kit (10 workplaces)

The level of laboratory equipment allows to carry out research works at the present level according to the plans of preparation of masters, graduate students, and doctoral students. The material and technical base is constantly updated taking into account the needs of research tasks, which are solved by the scientists of the department, graduate students, and students.







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4. RESEARCH ACTIVITY

Department of Instrument Making research in the following directions:

- Multi-axis transducers of mechanical quantities;
- Generalization and development of theory and experimental basis of the creation of gravimetric measuring instruments;
- Instruments and methods for measuring pressure;
- Devices and methods of energy-saving;
- Precision mechanical systems and medical devices;
- Development of sensors and transducers of physical quantities and their components for the measurement, monitoring, control, and diagnostics.
- Improving the accuracy and reliability of devices and systems;
- Algorithmic methods of devices and systems;
- Microprocessor technology and information systems;
- Mechanics of elastic elements of the devices and systems;
- The modern system of shock and vibration protection highprecision devices of the aircraft;
- Gravimetric techniques and instruments of measurement;
- CAD / CAE technology for the development of measurement instruments.

The main scientific directions of the **Department of Instrumentation Design and Engineering:**

- Mathematical modeling techniques and the study of physical processes processing of materials in modern instrument-making industry;
- Creation of intelligent systems production instrument;
- Computer preparation of production devices;
- Creation of laser optical-electronic, vibroacoustic, and electromagnetic diagnostic systems, monitoring and quality control of the production equipment;
- Study of the influence of laser and acoustic radiation biostructures and creation of medical systems based on it:
- Creation of specialized microprocessor systems for dentistry and orthodontics.



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Department has three research and teaching areas:

- Study of the physical fundamentals of materials processing and mathematical modeling of processes in the instrument;
- Study of principles of construction of diagnosing the state of process equipment systems, quality monitoring, and control products;
- Study of principles of construction of medical and systems for medical diagnostics based on biophysical interactions in cellular structures of living organisms.

Department of Orientation and Navigation Instruments and Systems performs research activities in the following directions:

- Research and development of algorithms and software for information processing, computer-aided design of complex technical systems, which are managed by incomplete and inaccurate information about their condition.
- Creation of modern element а base (solid-state wave gyroscopes, magnetosensitive elements, etc.), systems of orientation, stabilization, and inertial navigation systems, and the development of algorithms and software to correct them.
- Development of instrumentation and algorithms of control and processing of computerized complexes technical and medical diagnostics.

At the **Department of Optical and Optoelectronic Instruments** the following developments are being carried out:

- Design of onboard optical-electronic space-based systems;
- Ophthalmological instrument-making;
- development of optic-electronic devices for minimally invasive clinical medicine;
- Digital optical microscopy;
- Methods and tools for the computer-aided design of optical systems;
- Singular optics;
- Development of instrumentation for the determination of optical instruments and systems performance;
- Methods, tools, and metrology measurement of the energy characteristics of a lot of elemental detectors.







<u>Department of Non-Destructive Testing Instruments and Systems</u> performs research activities in the following directions:

- Methods of control of the stress state and fatigue of structural materials;
- Acoustic and eddy-current flaw mobile detectors;
- Ultrasonic methods and devices for medical diagnostics needs;
- Development of precision measuring instruments magnetic and electric fields;
- Electrical methods for mineral exploration;
- Research and development of a thermal method of non-destructive testing;
- Development of techniques to improve the quality of training of specialists in nondestructive testing and technical diagnostics.

Department of Information and Measuring Technique carry out investigations in the following areas:

- Theoretical foundations of experimental informatics;
- Methodology for building intelligent measuring, control, diagnostics, and expert systems;
- Information-measuring systems, complexes, and fundamental-measuring converters:

 Devices and systems for measuring the characteristics of random signals, measurement methodology;

- Study of electric and magnetic fields;
- Internet metrology;
- Theory of commuting sets;
- Metrology in nanotechnology;
- Metrology and measurement information technologies in distance education, research on monitoring and quality assessment of distance and local testing;
- Scientific and practical principles of information and metrological support for the implementation of technological processes in agricultural production.
- Methods and means of improving the accuracy of the AC voltage measurement;
- Methods of reproducing of the AC voltage unit;
- Metrological support of experimental research;



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- Harmonization of national standards with international and European standards;
- Methods and systems for monitoring and diagnostics;
- Methods and software in information technology;
- Digital signal processing;
- Stability study of components of measuring equipment;
- Computer-based ultrasonic non-destructive testing systems;
- Computer systems for electromagnetic field studies;
- Telemetry systems for aircraft testing.



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5. INTERNATIONAL PROJECTS AND COLLABORATION

<u>Department of Orientation and Navigation Instruments and Systems</u> supports international scientific relations with Technical University of Dresden (Germany), the European representative offices of firms "the Altera" and "Texas Instrument" (USA). The department staff took part in scientific conferences of the CIS countries, the USA, England, Germany on automation.

<u>Department of Optical and Optoelectronic Instruments</u> maintains scientific contacts with universities and research companies of Germany (Heidelberg University, University of Bremen, Kirchhoff Institute for Physics), Mexico (Instituto Tecnológico de Puebla, China (the Optical center, Juhani), The Netherlands (University of Amsterdam), Belarus (Belarusian State University, Minsk).

In 2011 the Department opened the French-Ukrainian master's program of receiving



two diplomas: Ukrainian the Igor Sikorsky KPI and the European Universite du Maine on Photonics and optoelectronic instrumentation. The program is open to graduates of higher educational institutions of Ukraine with the qualification of "bachelor" in "optical technology".

<u>Department of Non-Destructive Testing Instruments and Systems</u> is a member of the World Federation of NDT centers and has close relations with universities in the USA and Germany. Scientists of the Department regularly take part in conferences on nondestructive testing held in Ukraine and abroad. Members of the Department presented their reports and at scientific conferences in the U.S.

The Department collaborates with:

 Universität Würzburg – University Wurzburg (Germany) in the direction of nuclear magnetic resonance, magnetic resonance imaging.



• Federal Institute for Research and Testing of Materials (Berlin, Germany) in the simulation of the processes during the radiographic testing of materials.

The Department of Information and Measurement Technologies maintains direct contacts with the TH Mittelhessen University of Applied Sciences (Gießen, Germany), the Technical Universities of Munich and Trieste, the University of the Bundeswehr, the Zittau / Horlitz University, cooperates with well-known domestic and Western companies "National Instruments", "Analog Devices", "Hewlett Packard", "Rohde & Schwarz", "Siemens", "Motorola" "," Melexis "," Infopulse "," Promsat ". It allows to study and use the advanced world technologies, provides participation of



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foreign experts in the course of training of students, an exchange of students, teachers, and experts.



The department actively cooperates with the International Association of Student Exchange (IAESTE): every year the best students of the department undergo technological and undergraduate internships in Germany, the USA, Spain, Italy, Greece, Great Britain, Switzerland, France. Students from universities in Great Britain, Denmark, Germany, Sweden, Italy, Switzerland, and Finland are trained.

6. CONTACT INFORMATION

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