**"Educational and Research Institute of Nuclear and Heat Power is the leading educational and scientific division in the system of technical higher education institutes of Ukraine in the field of nuclear and thermal power, heat engineering and thermal physics"**

# INFORMATION PACKAGE

## EDUCATIONAL AND RESEARCH INSTITUTE OF NUCLEAR AND HEAT POWER

**Kyiv, 2023**

# CONTENT

*** *The information provided is current as of the 2023/2024 academic year.*

*Please note that minor changes may occur in the list of training specialties and educational programs/specializations for the next academic year.*

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# 1. COMMON DESCRIPTION OF THE INSTITUTE

**Educational and Research Institute of Nuclear and Heat Power (INHP)** is the leading educational and scientific division of the system of technical higher education institutes of Ukraine in the field of nuclear and thermal power, heat engineering, and thermal physics. The institute trains 120 academic groups of students in five specialties. The total number of students exceeds 1770 persons. The institute traditionally trains foreign undergraduate and graduate students from developing countries: Iran, Vietnam, Tunisia, Iraq, China, India, and Turkey.

Highly qualified teachers and educational support staff in a total of 204 persons provide the educational process. c, 60 associate professors, 25 assistant professors, 15 lecturers, and 91 persons of teaching and support staff.

# 2. STRUCTURE

**Institute of Nuclear and Heat Power** is a large educational and scientific complex that consists of five departments:

1. **Department of Power Process Automation;**
2. **Department of Nuclear Power Engineering;**
3. **Department of Software Engineering for Power Industry;**
4. **Department of Heat and Alternative Energetics;**
5. **Department of Digital Technologies in the Power Industry.**

The institute also has an extensive system of research units

- **NPP Reliability and Safety Research Center;**
- **Educational and Research Center for Nuclear Security Support;**
- **Educational and Research Laboratory of Cyber-energy Systems,**
- **Educational and Research Laboratory of computer modeling in energy;**
- **Educational and Research Laboratory of Methodical Support of Internet Technologies in Energy;**
- **Research (Experimental) Laboratory of Processes in Power Equipment;**

# 3. EDUCATIONAL PROGRAMS

***Levels of higher education***. Training of students in the **INHP** 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 – postgraduate studies, I-IV academic years. Applicants defend their dissertations and they are awarded the educational qualification of Doctor of Philosophy (Ph.D.).

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

**1. Department of Power Process Automation** provides training under the following Educational Programs:

| Specialty | Educational Program | Levels of higher education | | |
| --- | --- | --- | --- | --- |
| | | **First** | **Second** | **Third** |
| 174 Automation, Computer Integrated Technologies and Robotics | Automation and Computer-Integrated Technologies of Cyber-Energy Systems | Bachelor *EPP* | Master *EPP* | – |
| | Automation and Computer Integrated Technologies | – | – | Ph.D. *ESP* |

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

Graduates of the department are capable of performing the work on:

- automation and computerization of control processes in all areas of industrial production;
- development, design, and implementation of computer-integrated energy management

systems for TPPs, NPPs, in institutions that use solar, wind, various types of biofuels, etc.

- management of life support processes in industrial and public buildings (artificial climate, safety, engineering systems, etc.).

Specialists from many countries have been trained at the department, including citizens of Bulgaria, Germany, Poland, Cuba, Vietnam, Mongolia, China, Egypt, and Sweden.

**2. Department of Nuclear Power Engineering** provides training under the following Educational Programs:

| Specialty | Educational Program | Levels of higher education | | |
|---|---|---|---|---|
| | | **First** | **Second** | **Third** |
| **142** Power Machinery | Engineering and Computer Technology of Thermal Power Systems | Bachelor *EPP* | Master *EPP* | – |
| | Power Machinery | – | – | Ph.D. *ESP* |
| **143** Nuclear Power Engineering | Nuclear Power Plants | Bachelor *EPP* | Master *EPP* | – |
| | | | Master *ESP* | |
| | Physical Protection, Accounting, and Control of Nuclear Materials | – | Master *EPP* | – |
| | Nuclear Power Engineering | – | – | Ph.D. *ESP* |
| **144** Thermal Power Engineering | Thermal Power Engineering | – | – | Ph.D. *ESP* |

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

Graduates of an educational program "Nuclear Power Plants" are focused, first of all, on the most important and perspective sphere of energetics – nuclear power engineering.

They are trained to control the nuclear power plants, are engaged in the modeling of neutron-physical and heat-hydraulic processes in the equipment of NPP, and solve the problems of NPP reliability and safety. This activity requires thorough engineering, physicomathematical and computer skills, the ability to work with modern software codes, and knowledge of foreign languages.

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Graduates of the department have the exclusive right to obtain a license that allows them to manage nuclear power plants. They may occupy positions from engineer to Director General of the NPP, work in other subdivisions of the NNEGC "Energoatom"; the State Inspectorate for Nuclear Regulation, in scientific and technical institutions for the support of nuclear power plants operating and nuclear safety issues in international organizations such as the IAEA, VANO et al.

Students of the educational program "Engineering and Computer Technology of Thermal Power Systems" are focused on the study of heat and mass transfer processes, the development of heat exchangers, and thermal stabilization systems in the objects of power, aerospace, transport, and construction. All this requires thorough physical and mathematical, computer and engineering training, language skills, ability to work with modern software (Compass, AutoCAD, MathCAD, ANSYS, Fluent, ESATAN). Due to the advanced scientific base of the department, students have the opportunity to take part in national and international research projects.

Graduates have real prospects of career growth as the researcher, to get the scientific degree of Doctor of Philosophy (Ph.D.) and Doctor of Science. They occupy leadership positions in institutions of NAS of Ukraine, design organizations, leading local and foreign energy, and innovative companies. Under the guidance of such experts' energy efficiency and development of alternative energy, activities are implemented.

**3. Department of Software Engineering for Power Industry** provides training under the following Educational Programs:

| Specialty | Educational Program | Levels of higher education | | |
|---|---|---|---|---|
| | | **First** | **Second** | **Third** |
| **121** Software Engineering | Software Engineering of Intelligent Cyber-Physical Systems in the Energy Industry | Bachelor *EPP* | Master *EPP* | – |
| | | | Master *ESP* | |
| | Software Engineering | – | – | Ph.D. *ESP* |

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

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Students specializing in "Software Engineering" become top experts in the following areas: development of the latest management systems for complex technical and organizational systems; advancing the new technologies for the development and implementation of intelligent systems; meeting the challenges of improving the performance of any system using artificial intelligence, machine learning, big data processing, Internet of Things technologies, edge and cloud analytics, web and mobile application development.

Students explore the features of data mining technologies, use parallel computing tools, and create adaptive real-time distributed systems.

Attention is paid to both the basic disciplines of the theory and practice of



algorithmization and programming, computer modeling of complex systems, the formation and use of databases and knowledge bases, the development of translators, IT project management, as well as more specific, inherent in this direction: parallel computing, cloud technologies, asynchronous programming, DevOps methodology, cross-platform programming, design and development of intelligent software applications and their testing, disciplines of mobile device software development, Internet of Things and web programming.

The activity of the department is aimed at the development and widespread introduction of the latest information technologies, training of qualified specialists in the development of information, analytical and expert systems, as well as systems for automation of modeling and design of objects of different physical nature.

A feature of the department is that both leading experts in the field and scientists from foreign higher educational institutions are involved in the educational process.

The purpose of the training is to produce professionals who will be able to perform almost any task that requires the use of the latest information technologies and will be able to adapt to constant changes and improvements in software development tools.

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**4. Department of Heat and Alternative Energetics** provides training under the following Educational Programs:

| Specialty | Educational Program | Levels of higher education | | |
|---|---|---|---|---|
| | | **First** | **Second** | **Third** |
| **144** Thermal Power Engineering | Thermal Power Engineering and Thermal Power Installations of Power Plants | Bachelor *EPP* | Master *EPP* | – |
| | | | Master *ESP* | |
| | Energy Management and Engineering of Thermal Power Systems | – | Master *EPP* | – |
| | Thermal Power Engineering | – | – | Ph.D. *ESP* |

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

Department trains thermal power engineers to work on thermal power plants, in the installation and adjustment organizations, repair bases, energy associations, departments



of the Ministry of Energy, design, research, and educational institutions of Ukraine.

In the educational process, the department paid a lot of attention to the use of clean and efficient energy-saving technologies for the production of electricity and thermal energy, computer technology, gas turbine, and combined cycle power plant, the world experience in the field of new advanced energy technologies, on technical re-equipment, reconstruction, and modernization of energy assets.

Students of the department obtain universal education among similar departments of other universities. During training, the department uses modern teaching and laboratory and stand base, innovative computerized training methods, computer lab with free Internet access, Training and Scientific Center "KPI-BOSCH» with modern energy-efficient equipment (heat pumps, solar collectors, heat generators of the contact type and with the use of biomass).

Modern technologies of simulation and research of complex heat and power processes and systems, such as Solid Works, ANSYS, FlowVision, Dyrobes, Compas, AutoCAD, MathCAD, and others allow students to carry out complex and comprehensive studies.

Graduates of the department can operate, modernize, and design various power equipment for thermal and nuclear power plants.

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Graduates of the department work in positions of chief engineers, heads of departments, and directors of the energy supply of industrial and municipal enterprises, agro-firms, heads of representative offices of famous brands Bosch, Viessmann, Siemens, Buderus, Wilo, Grundfos, Vaillant, General Electric, IVIK HOLDING-GROUP, DTEK Energo LLC, Kyivenergo PJSC; JV "Kyiv Thermal Networks".

**5. Department of Digital Technologies in the Power Industry** provides training under the following Educational Programs:

| Specialty | Educational Program | Levels of higher education | | |
|-----------|---------------------|------|--------|-------|
| | | **First** | **Second** | **Third** |
| **122** Computer Science | Digital Technologies in Energy Industry | Bachelor *EPP* | Master *EPP* | – |
| | Computer Science | – | Master *ESP* | Ph.D. *ESP* |

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

Students of the "Computer Science" specialty become top experts in the following areas: development of the advanced management systems for sophisticated energy complexes; development of new technologies in the development and implementation of intelligent systems; solving problems to improve the efficiency of any systems using artificial intelligence technologies.

The department trains programmers - specialists in the field of software development.



The curriculum and qualified teaching staff of the department ensure that students acquire fundamental and applied skills for a wide range of professional tasks in designing, developing, testing, deploying and supporting software systems of various architectures and purposes. Education at the department involves learning the following **programming languages**: C#, C++, Java, PHP, Javascript, Prolog, Lisp, Erlang, Python. Languages for working with structured data: SQL, PL/SQL, ObjectScript. **Database management systems**: MS SQL Server, Oracle, MySQL, Cache, SQLight, MongoDB, IRIS, PostgreSQL.

Software development methods involve the use of artificial intelligence, virtual and augmented reality, computer vision, design patterns, MVC and MVP architectural patterns, and other modern architectural solutions and technologies.

**Development and design environments** to be studied: Microsoft Visual Studio, Eclipse, IntelliJ IDEA, NetBeans, PowerDesigner, PhpStorm, Android Studio, MathLab, SolidWorks, AutoCad, Adobe Photoshop, Adobe Illustrator, Sketch.

**Development tools and technologies** to be studied: Android SDK, Node.js, ODBC, ADO.NET, JDBC, Native DB, WCF, GRID, OpenMP, MPI.

### Basic disciplines of professional training

- Fundamentals of programming and algorithmic languages (C, C++, Java, C#).
- Object-oriented programming and software design patterns.
- Organization of databases, cloud, and GRID technologies.
- Programming of artificial intelligence systems.
- Distributed high-performance computing.
- Analytics of extremely large data sets.
- Post-relation databases.
- Design of Web systems with distributed databases.
- Cross-platform technologies for the development of distributed systems.
- Highly loaded Web systems.
- 3D modeling and visualization.
- Web user interfaces and their layout
- Means of information protection. Cryptography and encryption

The activity of the department is aimed at the development and wide implementation of the latest information technologies, the training of qualified specialists in the development of information, analytical and expert systems, as well as automation systems for modeling and designing objects of various physical nature. The purpose of the training is to produce specialists who will be able to perform almost all tasks that require the use of computing equipment and will be able to adapt to constant changes and improvements in computer devices.

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# 4. TRAINING AND LABORATORY BASE

The laboratories of the **Department of Power Process Automation** are provided with the most up-to-date equipment from world leaders Phoenix Contact, Unitronic, Schneider Electric, Honeywell, Siemens, Advantech, and Ukrainian companies RAUT-Automatik and Microl.

When implementing modern systems for automatic control of technological processes, an important component is the adjustment of control algorithms in the laboratory. Therefore, it is relevant to create a software system using modern programmable logic controllers for simulation of the operation of automatic control of a technological object.

Advanced automation systems use sophisticated network connections between smart devices to control process equipment. The algorithms of such systems include the analysis of the state of the industrial network and the application of emergency protection in the event of emergencies. Therefore, it is important to study the configuration of modern industrial networks, programming the operation of equipment in different modes, and the application of technological protection in the presence of appropriate conditions.

The above-mentioned tasks were the main ones in the development of new laboratories:

- EDUNET International Training and Technology Laboratory.
- Honeywell Smart Home.
- Laboratory of Basic Programming and Embedded Systems.
- Laboratory of Technological Measurements and Devices
- Laboratory of Automation Systems for Intelligent Buildings
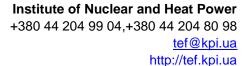- SIEMENS Industrial Automatics Laboratory
- CISCO Network Technology Lab

**Department of Nuclear Power Engineering** has a modern laboratory and technical basis for the study and general engineering disciplines. The department has two computer laboratories and two computer classes, equipped with modern technics. Computer classes have access to the Internet.

The department has six specialized laboratories for students' laboratory and workshop training. There is also an office for a course and diploma design with the library of the department.

The effectiveness of the learning process is enhanced by the use of the latest Internet technologies, and the "E-campus system."

At the **Department of Digital Technologies in the Power Industry** were created educational and research laboratories of computer modeling and cyber-physical systems, cloud, fog, and boundary computing to carry out educational and scientific activities by

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employees and students in cooperation with the department's Ukrainian partners-stakeholders.

Students participate in research projects within the framework of the Joint Sino-Ukrainian Scientific and Innovative Hydroacoustic Laboratory, as well as the Sino-Ukrainian Center for Engineering Innovations.

During their studies, students have the opportunity to gain knowledge on professional subject courses conducted by well-known IT companies such as EPAM and Huawei.

The department closely cooperates in educational and scientific areas with research institutes of the National Academy of Sciences of Ukraine, in particular with the Institute of Information Registration Problems of the National Academy of Sciences of Ukraine and the Institute for Modeling in Energy Engineering of the National Academy of Sciences of Ukraine.

Within the framework of projects of dual education, initiative scientific subjects, and the creation of a laboratory base, the department cooperates with the companies EPAM, LLC "Engineering Logic", LLC "Kvalitek".


Students of the **Department of Heat and Alternative Energetics** have 14 specialized laboratories for scientific and research work. In addition, in the educational process in the framework of dual education, the department widely uses the equipment of the Thermal Power Plant TPP-5 of Kyiv, Equipment Diagnostics Laboratory, and Laboratory of Metals of OJSC "Kyivenergo".

The department uses its laboratory base and the research base of leading enterprises to carry out scientific and research work by employees, students, master's students, and postgraduate students of the department, namely:

- Educational and Research Laboratory of Combustion Physics and the Study of the Characteristics of TPP Energy Equipment, which includes the "Combustion Problem" department. The laboratory has the appropriate technical equipment - a gas supply system with a gas pressure of up to 0.1 MPa, technical water supply, power supply, a machine park, air compressors with excess pressure;
- TPP and NPP Diagnostics and Automation Laboratory (computer class);
- Laboratory of Steam Turbines, Heat Engines, and Superchargers (computer class);
- Laboratory of Gas Dynamics of Turbine Equipment and Energy Ecology;
- Laboratory of TPP Regenerative Equipment;
- Thermal Measurement Laboratory of TPPs and NPPs;
- Laboratory of Diagnostics and Reliability of Energy Equipment;
- TPP and NPP Modeling Laboratory and Energy Equipment Resource Management;

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- Laboratory of Pipelines and Fittings;
- Laboratory of Heat Transfer Processes in Energy Equipment;
- Research and Educational Laboratory of Modern Energy-efficient Systems of Heating and Cooling of Buildings;
- Laboratory of Industrial Energy;
- Laboratory of Heat Exchangers;
- Laboratory of Renewable Energy Sources.

Appropriate measuring equipment is used to analyze the research results - potentiometers, water, gas, air meters, and gas analyzers. The results of the conducted research are processed using computers and SOLIDWORKS, ANSYS, etc. programs. Research on the development of a high-concentration coal dust supply system and the use of corresponding burners is being carried out at the Trypillia TPP research base.

In the Research and Educational Laboratory of Modern Energy-efficient Systems of Heating and Cooling of Buildings students study the work of the HISENSE inverter split system with a wall-mounted indoor unit and a plate heat exchanger in the heat supply system, contact heat and mass exchange during water cooling in cooling towers of water-based air conditioning systems, and heliothermal systems of hot water supply.

Students of the **Department of Heat and Alternative Energetics** study a complex of specialized disciplines, including: "Integrated computer technologies", "Mathematical modeling and optimization of processes and systems", "Sources of heat supply and consumers of heat", "Energy saving in heat supply", "Use of secondary energy resources", "Systems and installations for neutralization of industrial emissions", "Use of non-traditional energy sources" and others.

The department uses a modern educational laboratory and stands base, innovative computerized teaching methods, computer laboratories with free access to the Internet, educational and scientific center "KPI-Bosch" with modern energy-efficient equipment (heat pumps, solar collectors, contact type, and biomass heat generators).



Students of the department have the opportunity to get an education in foreign universities for one or two years under joint double degree programs and European grants in Germany, France, Sweden, Norway, Poland, and South Korea. After completing the master's degree, graduates have the opportunity to continue their postgraduate studies, using grant funding as well.

To carry out the educational process at the modern information level, the following laboratories have been created as part of the **Department of Digital Technologies in the Power Industry**:

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- Laboratory of Geometric Modeling and Intelligent Processing of Graphic Information.
- Laboratory of Computer Monitoring of Processes and Systems.

# 5. RESEARCH ACTIVITY

The research activity of the Institute is aimed at the solutions to two major interrelated problems, namely:

- Implementation of current research, developmental and technological works for the needs of energetics, industry, and social services to improve the energy efficiency of material production, increase energetic efficiency, reliability, and security of power generation and other equipment, increase the competitiveness of products, works and services in power, thermal power and thermal engineering.

- Improving the quality of training of engineers and scientists with an appropriate combination of cutting-edge fundamental and applied scientific research and development with the educational process.

**Department of Power Process Automation** conducts research and design works in the following directions of automation:

- Process control systems based on modern microprocessor technology;
- Computer simulators and their use for personnel training on management of process parameters;
- Modern technology of computer-aided design;
- Microprocessor control and regulation of energy processes and consumption of energy and resources.

According to the results of the last five years of scientific activity:

- 6 intellectual property rights certificates were obtained;
- 3 dissertations for the Ph.D. degree were defended;
- 7 international scientific conferences were organized;
- 2 monographs and four textbooks were published.

**The Department of Nuclear Power Engineering** has a powerful research division. Teachers, researchers, and students jointly carried out a lot of investigations and development work in the field of conventional and nuclear energy, energy efficiency, reliability and safety of thermal and nuclear power plants, development of new high-efficiency heat exchangers, and methods of their calculation.

The department developed

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- equipment based on heat pipes for cooling and temperature stabilization of onboard electronics of artificial satellites, the first micro-satellites of the Igor Sikorsky KPI PolyITAN,

- compact heat exchangers for utilization of the waste heat gas of fuel consumptive devices,

- new types of advanced heat transfer surfaces, which give an opportunity to significantly reduce metal consumption of energy equipment.

Research and development work at the **Department of Software Engineering for Power Industry** is carried out in the following priority directions:

- Development of software for modeling physical fields and processes,

- Data consolidation, intellectual analysis of texts,

- Analysis of large data sets,

- Intelligent transport systems,

- Development and research of digital twins, in particular, energy systems and equipment,

- Conceptual development of SMART infrastructure, design of cyber-physical systems.

The main directions of scientific activity in the **Department of Heat and Alternative Energetics** are:

- Theoretical and experimental investigations of hydrodynamics and heat and mass transfer in two-phase closed thermosyphons;

- Development and creation of industrial heat transfer devices;

- Research of thermal technologies of water desalination and intensification of heat and mass exchange processes;

- Development of innovative clean technologies for burning gaseous fuel in the combustion chambers of gas turbines, boilers, furnaces, and contact heat generators;

- Development of new energy systems "Aquarius" type heat generating apparatus of the contact type and biofuel (wood chips, pallets, wood waste, straw, etc.), and hydrogen.

- Development, research, and placement into service delivery system of highly concentrated coal dust in power boilers;

- Development of new technologies and high-performance burners for cleaner-burning gaseous fuels with reduced emissions of toxic nitrogen oxides in boilers, furnaces, combustion chambers of high-gas-turbine plants, and air heaters;

- Development of technologies and burners for combustion of secondary energy resources of vegetable origin;
- Estimation of the residual resource and extension of the service life of power equipment.

At the **Department of Digital Technologies in the Power Industry**, research work is carried out in the priority areas of science and technology development: Energy and energy efficiency, Information and communication technologies, namely:

- New computer tools and technologies of society informatization;
- Environmental assessment and conservation technologies for the sustainable development of industrial zones;
- The latest and resource-saving technologies in energy;
- Diagnostic tools and methods of treatment of the most common diseases.

# 6. INTERNATIONAL PROJECTS AND COLLABORATION

**Department of Power Process Automation** has become a full member of the international educational network EduNet, which is created and developed by one of the world leaders-manufacturers of automation tools – the German company Phoenix Contact. Due to this, students have access to the latest training techniques for innovative equipment and can try their hand in world-class professional competitions.

In 2018, the department had two winning Xplore New Automation Award 2018 student work projects:

- "Basanabar", was created to save lives in an accident.
- "Smart-city garbage and logistic systems", which showed the benefits of unified information space in the city.

The department works in several directions within the framework of international activity:

- Cooperation with foreign scientific and educational institutions;
- Cooperation with international and foreign commercial and non-profit companies and institutions.

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Within the framework of work with foreign scientific and educational institutions the departments established cooperation with the following institutions:

- KTH Royal Institute of Technology in Stockholm, Sweden;
- Auckland University
- Wrocław University of Science and Technology, Poland;
- Leipzig Higher Technical School, Germany.

The department participates in the Erasmus + program, under which students have the opportunity to study in foreign universities, and the scientific and pedagogical staff undergo internships.

Departments have established close mutually beneficial relations with commercial organizations – leaders in the fields of automation, namely:

- Phoenix Contact GmbH & Co.KG, Germany – automation tools and equipment for control systems;
- Klinkmann, Finland – all levels of Automated Process Control Systems and integration into the technological process ;
- Wonderware, USA – InTouch dispatching control systems, process modeling, MES systems;
- Honeywell, USA – a world leader in automation;

The department is a member of the Association of Industrial Automation Enterprises of Ukraine, which includes numerous international companies – https://appau.org.ua/chleny-appau.

The **Department of Nuclear Power Engineering** cooperates with the International Atomic Energy Agency (IAEA), the Swedish nuclear regulator Huawei Technologies Sweden AB.

Employees of the department participate in international scientific projects within the framework of the project "Creation of space technology and development of the concept of further joint production of new nanosatellites".

The department's foreign partners are the National Polytechnic Institute of Mexico, the Harbin Institute of Technology (China), the Institute for Problems of Materials Science named after I.M. Frantsevich, Georgian Technical University, Shenyang Aerospace University (China), Poznan University of Technology (Poland).

Students of the department have the opportunity to study and intern in the European countries under the Froling (Austria) summer school practice of the ERASMUS+ program and participate in the program of the second degree.

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The research and educational group of the **Department of Software Engineering for Power Industry** joined the international consortium (coordinator – *SketchPixel*, Portugal) within the project *CRASH – Development of a high precision reconstruction system designed to be used in a professional simulation environment related to real crash events.*

Employees and students of the department participate in international research projects within the research center *Smart City Research Center*, Polytechnic Institute of Tomar, Portugal (projects *Driver's Behavior Cognition Based on Mobile Phone Sensors* and *General Purpose Image Similarity Calculation for Heterogeneous Applications*).

The department's foreign partners are Polytechnic Institute of Tomar (Portugal), Norwegian University of Science and Technology (Kingdom of Norway), University of Malaga (Kingdom of Spain), Qilu University of Technology - Shandong Academy of Sciences (PRC), Guangdong CIS International Science and Technology Cooperation Union (PRC), Chongqing Liangjiang Innovation Center for Cyber Technologies (PRC), The Alliance of Guangzhou International Sister-City Universities (GISU), Shandong University of Science and Technology (PRC), Huawei ICT Academy.

A joint Sino-Ukrainian Scientific-innovative Hydroacoustic Laboratory, as well as a Sino-Ukrainian Center for Engineering Innovations, were created and are successfully functioning based on the department and the Special Design Bureau "Storm" of the university's Scientific Research Unit.

In the framework of cooperation between the Shandong Academy of Sciences and Igor Sikorsky KPI, Academy's employees are studying at the graduate school of Igor Sikorsky KPI.

Joint scientific research is carried out in the following areas: research of the physical fields of the marine environment, underwater information and telecommunication networks, driver behavior recognition based on mobile phone sensors, data consolidation, intelligent text analysis, analysis of large data sets, determination of the similarity of general-purpose images, systems for the reconstruction of traffic accidents, engineering of technologies for monitoring the development of international cooperation and creation of decision-making support systems in the scientific and technical sphere.

Students participate in academic mobility within the framework of Erasmus+ programs in higher education institutions in Spain, Italy, Luxembourg, Malta, the Netherlands, Germany, Norway, Poland, Portugal, Turkey, France, Croatia, and the Czech Republic.

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The **Department of Heat and Alternative Energetics** closely cooperates – has international agreements and contracts with the Warsaw University of Technology and the Opole Polytechnic University (Poland);- double diploma programs with the University of La Laguna (Spain), Zhejiang University of Science and Technology (Hangzhou, PRC), postgraduate scholarship double diploma program with Korea Institute of Science and Technology (Seoul).

Students of the department have the opportunity of studying and training under the ERASMUS+ program in Germany, Poland, Spain, and France, as well as to participate in the program for the second degree. Students from other countries, such as China, Ecuador, Venezuela, and others study at the department. Graduates work in research and design institutes in Ukraine, as well as in Europe, Asia, and America.

The scientific and educational group of the **Department of Digital Technologies in the Power Industry** has joined the international consortium (coordinator – SketchPixel, Portugal) within the framework of the CRASH project - *Development of a high precision reconstruction system designed to be used in a professional simulation environment related with real crash events under the Copromotion projects program – International Partnership, Notice Nº 12/SI/2020, Research Collaboration Program Between Companies and National and European Polytechnical Institutions.*

Employees of the department participate in international scientific projects within the Smart City Research Center, Polytechnic Institute of Tomar, Portugal. Projects: *The Driver's Behavior Cognition Based on Mobile Phone Sensors* and *General Purpose Image Similarity Calculation for Heterogeneous Applications.*

Joint scientific research is conducted in the following areas: computer modeling of objects and systems, intellectual analysis of texts, analysis of large data sets, determination of the direction and classification of marine objects in the world ocean, mathematical models of signals and interference, calculation of sound wave propagation parameters in the marine multilayered environment, underwater networks, data consolidation, intelligent analysis of texts, analysis of large data sets.

The department is a participant in the Erasmus+ program, where students and postgraduate students have the opportunity to study in foreign universities, and the scientific and pedagogical staff of the department have the opportunity to undergo internships.

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