

**«...students receive education  
on the level of the best world  
universities, as evidenced  
by the numerous victories  
in the international student's  
competitions in London,  
Budapest, Tehran, Prague,  
Warsaw, Bucharest,  
Munich...»**



## **INFORMATION PACKAGE**

## **EDUCATIONAL AND RESEARCH INSTITUTE OF PHYSICS AND TECHNOLOGY**

**Kyiv, 2021**

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# CONTENT

1. COMMON DESCRIPTION OF THE INSTITUTE.....	2
2. STRUCTURE.....	2
3. EDUCATIONAL PROGRAMS.....	3
4. TRAINING AND LABORATORY BASE.....	6
5. RESEARCH ACTIVITY.....	7
6. INTERNATIONAL PROJECTS AND COLLABORATION.....	8
7. CONTACT INFORMATION.....	9

**\*\*\* Information is current as for the 2021/2022 academic year. In the next academic year, there may be minor changes in training specialties and educational programs.**



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# 1. COMMON DESCRIPTION OF THE INSTITUTE

Technical protection of information is the activity aimed at preventing violations of integrity, blocking, and (or) leakage of information through technical channels.



In a market economy and accelerated development of high technologies, there is a growing demand for generalists, able to quickly change the nature of the professional activity, to reevaluate the experience, analyze the own opportunities, acquire new knowledge, using modern information technologies. **Educational and Research Institute**

**of Physics and Technology (IPT)** trains specialists who provide technological independence and information security of Ukraine.

During the training in Institute, students are educated at the level of the best universities in the world, as evidenced by the numerous victories in the international student's competitions in London, Budapest, Tehran, Prague, Warsaw, Bucharest, Munich.

Students of IPT have won more than 50 awards at international competitions in mathematics and programming (London, Los Angeles, Moscow, Munich, Tehran, Tokyo, and others.) Among the awards there are 6 Grand Prix at the International Mathematics Competition for University Students – the most prestigious student International Mathematical Olympiad), and about 200 awards in national student competitions.

## 2. STRUCTURE

**Institute of Physics and Technology consists of:**

- **Department of Applied Physics;**
- **Department of Information Security;**
- **Department of Mathematical Methods of Information Protection;**
- **Department of Mathematical Modelling and Data Analysis;**
- The complex of Training Laboratories in Physics;
- Computer Technology Training Laboratories;
- Training center for retraining and advanced training of specialists in the field of information security;
- Special Design Bureau "Storm";
- Scientific Laboratory of Information and Communication systems security;
- Scientific Laboratory of Methods of Registration of Optical Information.



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### 3. EDUCATIONAL PROGRAMS

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

At the first level (Bachelor's course, I–IV academic years) the students acquire fundamental knowledge in physics, mathematics, mechanics, computer engineering, 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 and defend a master's theses and acquire a master 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 (PhD).

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

**1. Department of Applied Physics** provides training under the following Educational Programs:

Specialty	Educational Program	Levels of higher education		
		First	Second	Third
Applied Physics and Nanomaterials	Applied Physics	Bachelor EPP	Master ESP	PhD ESP

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

Specialists obtain fundamental knowledge in higher mathematics, physics, and modern informatics according to the programs of classical universities, modern science.

In training subject "High Physical Technologies" the Department provides professional skills to solve the scientific problems in nanotechnology (synthesis of high-temperature superconductors, fullerenes, carbon nanotube composites, quasicrystals), nanomaterials (materials with unique properties), the physical fundamentals of information technology (data registration, processing, and storage).

The curriculum of training subject "Physics of Living Systems" devoted to the study of the fundamental laws of self-organization and functioning of living systems; solving problems of artificial intelligence; integration of biological and non-biological systems for the creation of intelligent microsystems for medical diagnostics.



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Students gain fundamental knowledge of general and theoretical physics, higher mathematics, methods of mathematical modelling of physical processes, computer programming, English. Professional knowledge allows them to solve fundamental and applied problems in the physics of the modern sources of energy, to implement new energy-saving technologies, to develop modern alternative energy sources, and increase the efficiency of the traditional sources.

**2. Department of Information Security** provides training under the following Educational Programs:

Specialty	Educational Program	Levels of higher education		
		First	Second	Third
Cyber Security	Systems of Technical Protection of Information	Bachelor <i>EPP</i>	Master <i>EPP</i>	–
			Master <i>ESP</i>	
	Systems, Technologies and Mathematical Methods of Cyber Security	Bachelor <i>EPP</i>	Master <i>EPP</i>	–
			Master <i>ESP</i>	
Cyber Security	–	–	PhD <i>ESP</i>	

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

The department provides fundamental and professionally oriented training for **IPT** students in higher mathematics, computer science, information security.

Fundamental training of applied mathematician is achieved by the mastering of the



classical branches of mathematics as mathematical and discrete analysis, mathematical logic and theory of algorithms, differential equations, the theory of functions of complex variables, functional analysis, probability theory, stochastic processes, and mathematical statistics.

Students are provided with a wide range of subjects related to computer technology and programming.

Considerable attention is paid to the use of supercomputers and supercomputer technologies in modelling, distributed, and cloud computing.

The training program "Mathematical Methods of Computer Modelling" is dedicated to the development and application of models and methods of applied mathematics to solve complex systems modelling problems, Big Data analytics and machine learning,



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management of knowledge and innovation, support for decision-making in the promising areas of the modern economy.

Cybernetic security experts study modern technology of information protection in cyberspace, master the principles of software protection from the action of malware, familiar with the process of creation of information security systems and information security management; acquire knowledge for a wide range of tasks in the field of cybersecurity – from the development and application of software and software and hardware protection of information in information and communications systems to investigate crimes in cyberspace. According to the program of training subject "Mathematical Methods of Cybernetic Security," students acquire the development and application of intelligent information processing methods for determining the state of security of the society, economy, and ecology; research dissemination of information in cyberspace; modelling of information flows, identifying, interpreting and responding to critical information flows (abnormal behavior, dangerous social processes); nonlinear modelling of people's behavior and communications.

**3. Department of Mathematical Methods of Information Protection** provides training under the following Educational Programs:

Specialty	Educational Program	Levels of higher education		
		First	Second	Third
Applied Mathematics	Mathematical Methods of Cryptographic Security	Bachelor <i>EPP</i>	Master <i>EPP</i>	–
			Master <i>ESP</i>	
	Applied Mathematics	–	–	PhD <i>ESP</i>

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

The department prepares professionals capable of solving the most complex



information security problems in the information and communication systems, which deal with discrete and algebraic transformations of information, including solving problems in mathematical cryptography and security problems of cryptanalysis; design, develop and meet the challenges of information protection means and cryptosystems maintenance; design, conduct development and maintenance of software

systems for special purposes; conduct studies on special subjects of mathematics, information protection and cryptology in the information and communication systems.



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Thorough knowledge of higher mathematics at the level of classical universities, information technology, as well as foreign language allows studying algebra, combinatorial analysis, and analysis of algorithms, information theory, and coding, cryptology at the level of world standards.

**4. Department of Mathematical Modelling and Data Analysis** provides training under the following Educational Programs:

Specialty	Educational Program	Levels of higher education		
		First	Second	Third
Applied Mathematics	Mathematical Methods of Modelling, Pattern Recognition, and Computer Vision	Bachelor <i>EPP</i>	Master <i>EPP</i>	–
			Master <i>ESP</i>	
	Applied Mathematics	–	–	PhD <i>ESP</i>

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

**IPT trains specialists** on modern subdisciplines of applied mathematics, physics, computer science, and information security. According to numerous reviews of employers, **IPT** fulfills its purpose: training elite-level specialists for science and high-tech sectors of the Ukrainian economy. Graduates have defended more than 50 dissertations (every sixth graduate of master's degree) in mathematics, physics, computer science in Ukraine, Europe, the USA, and Canada.

**Graduates of the Institute** are working in institutions of the National Academy of Sciences of Ukraine, state authorities of Ukraine, institutions, and companies of the state and non-state forms of ownership, where the basic requirements for employees are high intelligence, deep knowledge, ability to work in a highly intellectual competition.

Most graduates work in Ukraine and occupy the positions of leading specialists – scientists, analysts, experts, and developers.

## 4. TRAINING AND LABORATORY BASE

**IPT** uses universitywide premises and classrooms for training sessions.

Students can use the Igor Sikorsky KPI library services. Physical education classes are held in the sports complex. Students are provided with a hostel.



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## 5. RESEARCH ACTIVITY

**Institute of Physics and Technology** actively collaborates with institutes of the National Academy of Sciences of Ukraine, the Department of Informatization of the National Bank of Ukraine, the Department of Special Telecommunication Systems and Information Protection of Security Services of Ukraine, representative offices of Microsoft, Nortel Networks, Sun Microsystems in Ukraine and several institutions and companies of state and private forms of property.

The main directions of scientific work of the departments:

### *Department of Applied Physics*

- development of cooled IR matrix converters, nanostructures of multi-element hybrid pyroelectric detectors;
- research in the field of scientific instrument making, optoelectronic devices based on new semiconductor materials;
- physical research in human biophysics and physiology.
- thermal and gas-dynamic processes in complex swirling flow;
- film cooling of gas turbine blades;
- thermogasdynamics of heat transfer surfaces with the hollows on the surface;
- new thermodynamic cycles of power plants;
- development and research of functional materials by non-traditional methods.

### *Department of Information Security*

- mathematical methods of analysis and synthesis of nonlinear physical processes;
- quantum information technology;
- modelling of ordered and disordered systems;
- mathematical methods of modelling and designing of information security systems;
- security of information and communication systems.
- radio technical devices and microwave systems;
- electronic and electroacoustic systems of technical protection of information;
- optimization of the design of technical protection of information systems.



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## Department of Mathematical Methods of Information Protection

- methods of mathematical analysis and synthesis of cryptographic information changes;
- theory of reliability and risks;
- probabilistic methods in the combinatorial analysis;
- methods for differential analysis of block ciphers;
- standardization in the field of information security;
- models of cryptographic systems and methods of implementation of cryptographic mechanisms of information protection.



## 6. INTERNATIONAL PROJECTS AND COLLABORATION

**Institute of Physics and Technology** is actively working in the direction of academic mobility of students abroad, credit mobility ERASMUS +.

International relations have been established with the scientific institutions of Germany and Ireland.

### Germany

- Jülich Research Centre

### Ireland

- University College Dublin.



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