

"... the faculty belongs to the most respected institutions in the world chemical science..."



## INFORMATION PACKAGE

## FACULTY OF CHEMICAL TECHNOLOGY

**Kyiv, 2020**

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**\*\*\* The 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/specializations.**



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# 1. COMMON DESCRIPTION AND THE STRUCTURE OF FACULTY

**Faculty of Chemical Technology (FCT)** was founded simultaneously with the Kyiv Polytechnic Institute in 1898. From the earliest days until now, the faculty belongs to the most respected institutions in the world of chemical science due to the contributions made by the distinguished scientists. Now the team of teachers and researchers of **FCT** maintains and develops the best traditions of teaching skills and creative scientific research. Faculty of Chemical Technology ensures all the graduates by real employment



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**Structure.** Faculty of Chemical Technology consists of seven departments.

## 1. Department of Organic Chemistry and Technology of Organic Substances.

Department provides general scientific training of students in organic chemistry and trains professionals with a degree in "Chemical Technology and Engineering" (educational program/specialization "Chemical Technology of Organic Substances").



The essence of the specialty is the development of methods for production and operation of process plants for the production of a wide variety of organic synthesis products: monomers for high molecular compounds, dyes, medicines, insect pest and weed control, solvents,

corrosion inhibitors, preserving agents, perfumes, detergents, etc., scientific research in organic chemistry and related fields. Specialists obtain thorough training in general chemical, scientific, engineering, and economic disciplines, as well as in chemical engineering and special disciplines.

## 2. Department of Technology of Inorganic Substances, Water Treatment, and General Chemical Technology

is accredited to train experts with a degree in "Chemical Technology and Engineering" (educational program/specialization "Chemical Technology of Inorganic Substances and Water Treatment").



Graduates work as experts not only in the workshops and laboratories of the chemical and related industries but also in the academic and



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industrial research institutes, in the administrative structures, in the design and environmental departments, as well as the professors in institutes of higher education. A thorough grounding in chemistry allows department graduates (fluent in foreign languages) successfully continue their education not only in doctoral school at the department or other academic institutions in Ukraine but also in Germany, Switzerland, the Netherlands, Norway, United States, internships in the EU countries.

**3. Department of Electrochemical Productions Technology** trains experts with a degree in "Chemical Technology and Engineering" (educational program /specialization "Electrochemical Technology of Organic and Inorganic Materials"). Graduates are capable of knowledgeably solve the issues of production, carry out ecological monitoring of the environment, introduce into production new instruments for corrosion measuring based on the developed corrosimeter, design new types of sensors, implement electroplating technology, carry out research on related technologies.



The department engaged in basic training in the theory of electrochemical processes, materials, and component science, the design of new technologies based on advanced materials; the development of new technologies for the protection of metals from corrosion.

**4. Department of Chemical Technology of Ceramics and Glass** trains professionals with a degree in "Chemical Technology and Engineering" (educational program/specialization "Chemical Technology of Inorganic Ceramic Materials").



Students gain complex knowledge of inorganic, analytical, and physical chemistry, solid-state chemistry and chemistry of silicates, chemical engineering, and environmental chemistry. At the same time, importance is placed on modern teaching methods, computerization of the educational process. Senior students have the opportunity to perform graduate works at the institutes of the National Academy of Sciences and to have short-term training in the universities of the USA and Europe.



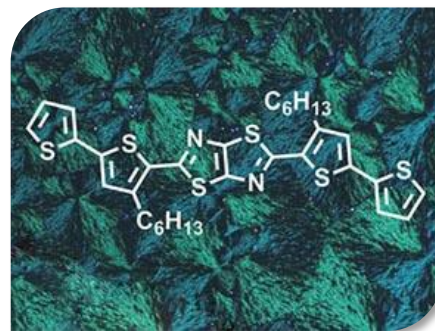
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**5. Department of Chemical Technology of Composite Materials** trains professionals with a degree in "Chemical Technology and Engineering" (educational program/specializations "Chemical Technology of Organic and Inorganic Binder and Composite Materials").

During training, students have the opportunity to participate in the implementation of research and development work that is carried out at the department. Recently, the department establishes international scientific relations with the relevant academic and scientific institutions from various countries (Germany, Poland, Bulgaria, USA, Mongolia, Vietnam, Cuba, Egypt, Jordan, Morocco, and others).



**6. Department of Physical Chemistry** trains professionals with a degree in

"Chemical Technology and Engineering" (educational program/specialization "Chemical Technology of Cosmetic and Food Additives"). Graduates are capable of producing nutritional supplements and cosmetic products, knowing how to apply them without harmful aftereffects for persons, possess the methods of food additives monitoring in the finished product. They are in demand in the food, cosmetic and chemical industries, research institutions, government

bodies responsible for supervising the quality of products and their certification.



**7. Department of Cybernetics of Chemical Technology Processes** trains professionals with a degree in "Automation and Computer-integrated Technologies" (educational program/specialization "Computer-integrated Sustained Chemical Productions").

It is difficult to imagine the performance of modern enterprise without the use of computer-integrated technologies. The design of energy and resource-efficient companies, the creation of automated process control systems, development of new substances and blends – it is an incomplete list of areas of application of knowledge obtained by students during the training.



Department graduates successfully work at various technological enterprises, data centers, commercial and banking structures, scientific, industrial and political fields, and in particular, in all the departments of the Faculty of Chemical Technology.



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**8. Department of General and Inorganic Chemistry** trains students in Chemistry, General Chemistry, General and Inorganic Chemistry, Chemistry and Electric Radio Materials, Properties of Chemical Elements and Compounds in the vast majority of the Igor Sikorsky KPI faculties.

Scientific interests of the department are focused in the area of theoretical and applied research of complex d-elements compounds, synthesis, and study of the nanostructured materials properties, development of materials to improve energy storage systems (Li-ion batteries), and others.



## 2. EDUCATIONAL PROGRAMS

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

At the second level, (Master's course, I-II 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's course and Master's course), 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.

Students have the opportunity to obtain a second degree in Management, Marketing, Law, Banking, and Philology (foreign language) – on individual request.

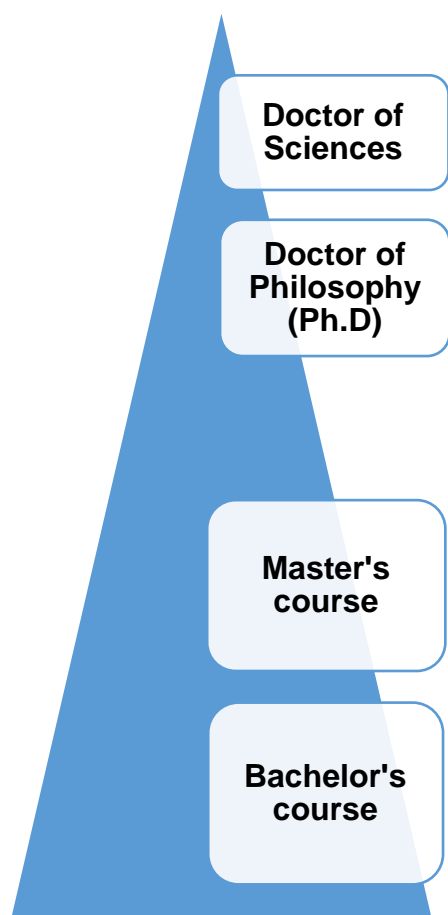


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## Specialties and educational programs/specializations:



### Chemical Technology and Engineering

#### Chemical Technology and Engineering

- Chemical Technology of Inorganic Substances and Water Treatment
- Chemical Technology of Organic Substances
- Chemical Technology of Cosmetics and Food Additives
- Electrochemical Technology of Organic and Inorganic Materials
- Chemical Technology of Inorganic Ceramic Materials
- Chemical Technology of Organic and Inorganic Binder and Composite Materials

**Faculty of Chemical Technology** trains professionals in various areas of theoretical and applied chemistry, who are capable to research the laboratory or large-capacity synthesis of new organic and inorganic compounds for various purposes – inhibitors of corrosion to the materials of electronics and space technology, to develop and design the modern eco-friendly chemical technology, production of chemicals, coagulants, ceramic, silicate, silicone, elastomer, plastic and many other materials, metals and coatings.

#### **Graduates are capable:**

- create mathematical models of chemical processes and manage them with the use of computer technology
- implement environmental solutions to protect the environment from pollution
- carry out an environmental audit

#### **FCT graduates work in the:**

- chemical divisions of the National Academy of Sciences
- industrial research institutes
- companies of chemical and related profile



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- government institutions
- chemical and allied industries,
- Sanitary and Epidemiological Service
- institutions of environmental inspection and monitoring
- scientific and technical divisions of public law enforcement agencies
- stations of drinking water and wastewater treatment

### 3. TRAINING AND LABORATORY BASE

A high level of specialist training is provided by the presence of the necessary educational and technical base. During the study of the chemical, engineering, and special disciplines students carry out a lot of laboratory works, so the department graduates acquire skills in the performance of chemical experiments. The vast majority of students take part in research works under the guidance of the highly qualified academic staff of the department and leading scientists of the National Academy of Sciences of Ukraine.

Six specialized training laboratories operate at the **Department of Organic Chemistry and Technology of Organic Substances**: 4 Laboratories of Synthesis of Polycyclic Aromatic Compounds in Pharmaceutical Chemistry and Nanoelectronics, Laboratory of Chromatographic and Mass Spectrometric Analysis, and Laboratory of Nuclear Magnetic Resonance. Laboratory equipment meets modern conditions of synthetic studies and includes chromatograph with mass spectrometric detector Hewlett-Packard +5990, capillary chromatograph Shimadzu GC-14C, NMR spectrometer Jeol, infrared spectrophotometer Specord IR-80, rotary evaporators, autoclave, electronic scales, etc.

**Department of Technology of Inorganic Substances and General Chemical Technology** has 5 specialized training laboratories: the laboratory of water treatment technology and applied ecology; laboratory of biotechnology; laboratory of general and special chemical technology; laboratory of nanochemistry, nanotechnology, and thermochemistry; laboratory of precision analysis methods.

Laboratory equipment meets modern conditions of chemical-technological and biotechnological research and includes complex apparatus for water purification from leading US firm "Dow Chemical", chromatographs, infrared spectrophotometers, rotational viscometer, ultrasonic dispersers, derivatographs, automatic coagulative technics, automatic meters of aqueous solutions concentration, raster electron microscope, photoelectrocolorimeters, ionometers, atomic absorption spectrometer, laser technics, X-ray fluorescence machine, electronic scales, etc.



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Certified Research Laboratory of Adsorption and Ion Exchange and Research Laboratory of Chemistry and Technology of Macromolecular Natural Compounds operates at the department.

***Department of Chemical Technology of Composite Materials*** has laboratories equipped with modern scientific instruments: spectrometers, electron microscope, equipment for X-ray diffraction analysis, derivatograph, IR-spectrometers, technological stands, a modern computer lab with Internet access.

## 4. RESEARCH ACTIVITY

### *The main scientific directions of the faculty:*

Scientists of FCT perform research works according to:

- programs of the Ministry of Education and Science of Ukraine, Ministry of Industrial Policy, National Academy of Sciences of Ukraine, the Foundation for Fundamental Research of Ukraine
- international grants INTAS, NATO, COPERNICUS
- contracts with commercial firms and industrial companies
- agreements with research centers of the Netherlands (Institute of Catalysis, Eindhoven), Germany (Dortmund University), Norway (Institute of Natural Sciences), USA (University of Arizona), France (Lyon Research Center), and others.

Faculty works in the following directions: scientific work, training of scientific personnel, innovative activity.

### *Areas of scientific interests of the departments:*

#### ***Department of Technology of Inorganic Substances and General Chemical Technology:***

- scientific and technological fundamentals of the synthesis of sorbents, coagulants, flocculants, new classes of catalysts for inorganic and organic synthesis, petrochemicals, environmental catalysis;
- water treatment and water purification (drinking water preparation and purification of polluted wastewater of different origin);
- the complex chemical and biological technology of raw materials processing, recycling, and disposal of solid and gaseous wastes and emissions;
- development of linear compositions for industrial use;
- nanochemistry and nanotechnology of inorganic materials.



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### ***Department of Organic Chemistry and Technology of Organic Substances***

- development of a new synthesis of advanced anti-malarial drugs;
- development of methods for the synthesis of framework amino acids – advanced neuromodulators of the central nervous system;
- development of selective methods for functionalization of polyadamantanes and diamondoids – potential elements of nano- and microelectronic devices;
- experimental and computerized study of mechanisms of substitution in the boundary hydrocarbons.

### ***Department of Electrochemical Productions Technology:***

- development of sensors to monitor the environmental safety of the air and technogenic environment; integrated sensor systems for testing of animal and plant products;
- research and creation of electrocatalysts and electrode materials for electrochemical industries;
- development of methods and means of electrochemical corrosion activity monitoring of technogenic environments; devices for corrosion monitoring and active protection of power equipment and long-distance pipelines;
- galvanic protective, decorative and functional metal and composite materials coatings;
- electrochemical methods of environmental protection;
- theory of metal corrosion, and inhibitor methods of metals protection in industrial and biological environments;
- electrochemical power production: chemical sources of electricity and electrochemical generators.

### ***Department of Chemical Technology of Composite Materials:***

- development of the theoretical fundamentals of the creation and stability of chemisorbed silicone coatings, composites, and hydrophobic protection materials;
- creation and development of integrated technologies for the production of environment-friendly pure coatings and composite materials, using after-products;
- research and development of technology for production of both the modified sorbents and fillers and coating materials for enforcement of building of architectural and historical significance;
- development of transport and protective containers for storing environmentally hazardous, toxic, and radioactive waste;
- creation of scientific fundamentals of multifunctional materials based on sol-gel technology;
- research in the field of chemistry and technology of mineral binders (cement) and the area of their use.



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### ***Department of Chemical Technology of Ceramics and Glass:***

- development of new functional ceramic and glass materials;
- physical-and-chemical study of the natural silicates properties and modification of their surface;
- solving the problem of resource and energy saving in the production of silicate materials and goods;
- development of the fundamentals of using alternative materials and industrial waste;
- development of high-performance sorbent materials to protect water resources from pollution by toxic and radioactive metals.

### ***Department of Physical Chemistry:***

- theoretical modeling and development of molecular energy storages – ultracapacitors;
- physical chemistry of non-aqueous solutions;
- physical and chemical analysis of fluid systems;
- kinetics and mechanism covalent bond heterolysis

### ***Certified Research Laboratory of Adsorption and Ion Exchange:***

- study of the sorption and membrane materials properties for the development of high-performance technologies for the treatment of aqueous solutions of unwanted impurities;
- development of low-waste technologies for the treatment of industrial process solutions and wastewater with the recycling of valuable components;
- environmental and engineering consulting in the field of sorption and membrane water treatment technologies.
- certification studies of drinking water, beverages, sorption, and membrane materials.

### ***Research Laboratory of Chemistry and Technology of Macromolecular Natural Compounds:***

- study of the cellulose derivatives properties;
- development of technologies and medical sorbents for endoecological purposes.

### ***Department of General and Inorganic Chemistry:***

- mixed-ligand and heterometallic complexes of 3d-metals with amino alcohols and N, O-donor atoms: synthesis, structure, properties, use;
- inorganic nanomaterials: nanoparticle oxides of stannum, titanium, niobium, tantalum – synthesis, properties, applications;



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- electroactive materials for energy conversion systems: graphite materials, modified by pyrolysis products of heterometallic complex compounds of 3d-metals; a positive electrode oxide materials of Li-ion batteries.

## 5. INTERNATIONAL PROJECTS AND COLLABORATION

The recent international project of the Faculty of Chemical Technology is an international educational project "Water Harmony" – a joint Norwegian-Eurasian program of training specialists and masters in Water and Water Treatment (2011-2014).

**Department of Organic Chemistry and Technology of Organic substances** has close creative relationships with the Institute of Organic Chemistry of the National Academy of Sciences of Ukraine (NASU), the Institute of Bioorganic Chemistry and Petrochemistry of NASU, Institute of Physical Chemistry of NASU, the Institute of Natural Resources of the University of Minnesota (USA), University of Georgia (USA), University of Göttingen (Germany), Technical University of Braunschweig (Germany) and performs joint research works.

**Department of Technology of Inorganic Substances and General Chemical Technology** is recognized as the leading subject department in Ukraine. Department supports creative relationships with related departments of Ukraine and CIS countries, participates in the international symposiums on Chemical Engineering and Industrial Ecology, organizes and holds scientific-technical conferences and seminars (the department organized 2 scientific conferences of the CIS countries on the chemical technology of inorganic substances).

Students of the department have the opportunity:

- To participate in the study and scientific tours in leading foreign universities and research centers (France, Germany, USA, Poland, Canada, Italy, South Korea, Norway, Sweden, and Japan).
- To study in foreign partner universities of the Igor Sikorsky KPI for 1 or 2 years according to the master's program of the FCT with the defense of master's diploma works both at the foreign university and at the faculty to get so-called "double master's degree in Chemistry and Chemical Technology".



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**Department of Chemical Technology of Ceramics and Glass** support international relations with

- Environmental Protection Agency, USA
- Michigan State University, USA
- University of Texas, USA
- Katholieke Universiteit Leuven, Belgium
- Austrian Research Centers of Seibersdorf
- Universite du Maine, France
- Institut National Agronomique, Paris, France
- Universidad de Granada, Spain
- Institute of Environmental Geology and Geoengineering, Roma, Italy
- Institute of Steel and Alloys, Moscow, Russia
- National Centre for Disease Control and Public Health, Tbilisi, Georgia



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### 4. Department of Electrochemical Productions Technology

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