**MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE**
**NATIONAL TECHNICAL UNIVERSITY OF UKRAINE**
**"IGOR SIKORSKY KYIV POLYTECHNIC INSTITUTE"**

APPROVED
by Academic Council of
Igor Sikorsky Kyiv Polytechnic Institute
(protocol № ___ dated «___» _____ 20___ p.)

Head of the Academic Council
_____Mykhailo ILCHENKO

# INDUSTRIAL ECOLOGY AND RESOURCE EFFICIENT CLEANER TECHNOLOGIES

# EDUCATIONAL AND PROFESSIONAL PROGRAM

## first (Bachelor's) level of higher education

| | |
|---|---|
| **Program Subject Area** | **161 Chemical Technology and Engineering** |
| **Field of Study** | **16 Chemical and Bioengineering** |
| **Qualification** | **Bachelor of Chemical Technology and Engineering** |

Came into force in 2022/2023 study year
by the Order of Rector
of Igor Sikorsky Kyiv Polytechnic Institute
dated _____ 20___ №_____

Kyiv – 2022

## PREAMBLE

**DEVELOPED** by the project team:

**Project team leader**:
**Deikun Iryna Mykhaylivna**, PhD, Associate Professor, Associate Professor of the Department of Ecology and Plant Polymers Technology _____

**Project team members:**
**Gomelya Mykola Dmytrovych**, Doctor of Technical Sciences, Professor, Head of the Department of Ecology and Plant Polymers Technology

**Halysh Vita Vasylivna**, PhD, Associate Professor, Associate Professor of the Department of Ecology and Plant Polymers Technology

**Savchenko Stefaniya Serhiyivna**, Deputy Head of the Technological Department of the Banknote Paper Mill of the Banknote Printing and Minting Works of National Bank of Ukraine

**Gubal Maryana Romanivna**, student of the 3rd year of the group LC-91

**AGREED:**
Scientific and Methodological Council of Igor Sikorsky Kyiv Polytechnic Institute for program subject area 161 «Chemical Technology and Engineering»

Head of the SMC 161
_____ Olga LINYUCHEVA
(protocol № 3 dated «_22_» November 2021)

Methodological Council of Igor Sikorsky Kyiv Polytechnic Institute
Head of the Methodological Council
_____ Yuriy YAKYMENKO
(protocol № 2 dated «_9_» December 2021)

**CONSIDERED:**

According to the results of the review and external approval of the EP, after receiving all the suggestions and proposals of stakeholders (LLC «Mokvyn Paper Mill», PrJSC « Kyiv Cardboard and Paper Mill»), the educational and professional program was discussed at a meeting of the Department of Ecology and Plant Polymers Technology (protocol №_5_ dated 17.11.2021). The results of the discussion in the form of an extract from the department meeting were forwarded to NMCU 161 «Chemical Technology and Engineering».

In accordance with the order of the Ministry of Economy of Ukraine № 810-21 dated 25.10.2021 "On the approval of Amendment № 10 to the national classifier DK 003:2010" the list of professions for graduates regarding employment has been changed in the program. The list of educational components was also detailed.

**CONTENT**

# 1. PROFILE OF THE EDUCATIONAL PROGRAM

| 1 – General information | |
|---|---|
| Full name of HEI and institute / faculty | National Technical University of Ukraine<br>"Igor Sikorsky Kyiv Polytechnic Institute",<br>Faculty of Chemical Engineering |
| Higher education level and title of qualification in the original language | HE Degree – Bachelor<br>Educational qualification – Bachelor of Chemical Technology and Engineering |
| The official name of the educational program | Industrial ecology and resource efficient cleaner technologies |
| Type of diploma and scope of educational program | Bachelor's diploma, single, 240 ECTS credits, training period 3 years and 10 months |
| Availability of accreditation | Certificate of accreditation of the Programme Subject Area by the Ministry of Education and Science of Ukraine НД № 1192566 in accordance with the decision of the Accreditation Commission dated 26.04.2013, protocol № 103, Order dated 30.04.2013 № 1480-л, valid until July 1, 2023 |
| Cycle / level of HE | NFQ of Ukraine - level 6<br>QF-EHEA - the first cycle<br>EQF-LLL - level 6 |
| Prerequisites | Complete general secondary education |
| Language (s) of instruction | Ukrainian |
| Term of the educational program | Until the next accreditation |
| Internet address of the permanent placement of the educational program | *https://eco-paper.kpi.ua/*, section "Educational programs"<br>*https://osvita.kpi.ua/* section "Educational programs" |
| **2 – The goal of the educational program** | |
| Training of professionals capable of solving complex specialized tasks, solving practical problems of implementation, design and improvement of existing technologies of chemical processing of plant raw materials and systems and technologies of environmental protection from negative anthropogenic influence, carrying out organizational activities; and, through a harmonious combination of fundamental knowledge and engineering tools with training in the humanitarian field, successfully compete on the labor market in conditions of sustainable innovative scientific and technical development of society<br>Corresponds to the development strategy of Igor Sikorsky Kyiv Polytechnic Institute for 2020-2025 (https://data.kpi.ua/sites/default/files/files/2020-2025-strategy.pdf). | |

| 3 – Characteristics of the educational program | |
|---|---|
| Subject area | *Objects* – technological processes and equipment of modern chemical industries.<br>*Learning objectives* – training of specialists capable of solving complex specialized tasks and practical problems of chemical technologies and engineering, characterized by complexity and uncertainty of conditions.<br>*Theoretical content of the subject area* – concepts, categories, principles of chemical technologies, processes and equipment of chemical production.<br>*Methods, techniques and technologies:* physical and chemical methods, modeling and design of chemical processes and equipment, organizational and technological support.<br>*Tools and equipment*: devices and instruments for the analysis of raw materials, intermediate and target products, control and measuring equipment, specialized technological equipment, specialized software. |
| Orientation of the educational program | Educational and Professional |
| The main focus of the educational program | *Special education* in «Chemical and Bioengineering» Program Subject Area 161 – Chemical Technology and Engineering.<br>The program is based on well-known scientific provisions in the field of chemical technologies for the processing of plant polymers and protection of the environment from technogenic pollution, taking into account the up-to-date level of technology, it focuses on the current problems of chemical production, which ensures the further professional and scientific growth of students in the field of chemical technologies and industrial ecology.<br>Key words: plant polymers, cellulose, paper, cardboard, chemical fibers, resource saving, environmental protection, cleaner technologies. |
| Features of the educational program | Interdisciplinary and multidisciplinary training of specialists in chemical technologies of plant polymers processing and industrial ecology.<br>The program provides for pre-diploma practice at companies and specialized institutions; participation of applicants for higher education in student scientific circles; the possibility of teaching individual special courses in a foreign language, international activities in the field of mobility and internships for students and teachers. |
| **4 – Qualification of graduates for employment and further studying** | |
| Qualification for employment | *Professional qualification* (according to Classifier of professions ДК 003:2010)<br>3119 - technologist<br>3152 - product quality control inspector<br>3439 - state inspector for technogenic and environmental supervision<br>2146.2 - chemical engineers:<br>technological engineer (chemical technologies)<br>engineer (chemical technology)<br>water treatment technologist<br>2149.2 - engineers (other branches of engineering). |

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| Further training | The possibility of studying in the program of the second (master's) level of higher education. Acquisition of additional qualifications in the postgraduate education system. |
| **5 – Teaching and evaluation** | |
| Teaching and learning | Student-centered learning through lectures, seminars, practical classes; personal differentiated and problem-oriented learning through laboratory and pre-diploma practice, self-study through consultations with a teacher, individual classes. Full preparation for professional activities is provided through participation in scientific and innovative projects with the publication of results in professional journals. Opportunities for approbation of research results are provided, in particular, due to the annual International Scientific and Practical Conferences "Ecology. Human. Society" and "Clean water. Fundamental, applied and industrial aspects". |
| Evaluation | Current and semester control is carried out in the form of reports, presentations, tests, written and oral exams in accordance with the Rating system. |
| **6 – Program competencies** | |
| Integral competence | The ability to solve complex specialized tasks and practical problems of chemical technologies and engineering, which involves the application of theories and methods of chemical technologies and engineering and is characterized by the complexity and uncertainty of conditions. |
| **General competences** | |
| C 01 | The ability to abstract thinking, analysis and synthesis. |
| C 02 | The ability to apply knowledge in practical situations. |
| C 03 | Knowledge and understanding of the subject area and understanding of professional activity. |
| C 04 | The ability to communicate in the national language both orally and in writing. |
| C 05 | The ability to communicate in a foreign language. |
| C 06 | The desire to preserve the environment. |
| C 07 | The ability to realize own rights and responsibilities as a member of society, to be aware of the values of civil (free democratic) society and the need for its sustainable development, the rule of law, the rights and freedoms of a person and a citizen of Ukraine. |
| C 08 | The ability to preserve and multiply moral, cultural, scientific values and achievements of society based on an understanding of the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society. |
| **Professional competencies of the specialty** | |
| C 09 | The ability to use the provisions and methods of fundamental sciences to solve professional tasks. |
| C 10 | The ability to use methods of observation, description, identification, classification of objects of chemical technology and industrial products. |
| C 11 | The ability to design chemical processes taking into account technical, legislative and environmental limitations. |
| C 12 | The ability to use modern materials, technologies and equipment designs in chemical engineering. |

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| C 13 | The ability to choose and use appropriate equipment, tools and methods for control and management of technological processes of chemical production. |
| C 14 | The ability to use computing and information technology to solve complex tasks and practical problems in the field of chemical engineering. |
| C 15 | The ability to take into account the commercial and economic context when designing chemical plants. |
| C 16 | The ability to draw up technical documentation in accordance with current requirements. |
| C 17 | The ability to use computer-aided design systems to develop design documentation. |
| C 18 | The ability to apply up-to-date experimental methods of working with technological objects in industrial and laboratory conditions. |
| C 19 | The ability to determine the directions of use of plant raw materials and fibrous semi-finished products, to design and implement technologies for their processing. |
| C 20 | The ability to use the theoretical fundamentals of ecology, environmental protection and sustainable nature management, the basic principles and components of environmental management. |
| C 21 | The ability to distinguish the technological processes of production, to determine the sources and ways of entering the natural environment of harmful components, to assess their impact on human health and the quality of the environment. |
| C 22 | The ability to design and implement technologies for purification and processing of exhaust gases, wastewater and solid waste. |
| **7 – Program learning outcomes** | |
| PO 01 | To know mathematics, physics and chemistry at the level necessary to achieve the results of the educational program. |
| PO 02 | To correctly use the terminology and basic concepts of chemistry, chemical technologies, processes and equipment for the production of chemicals and materials based on them in professional activities. |
| PO 03 | To know and understand the mechanisms and kinetics of chemical processes, effectively use them in the design and improvement of technological processes and apparatus of the chemical industry. |
| PO 04 | To carry out qualitative and quantitative analysis of substances of inorganic and organic origin, using appropriate methods of general and inorganic, organic, analytical, physical and colloidal chemistry. |
| PO 05 | To develop and implement projects related to chemical production technologies and equipment, taking into account objectives, resources, existing constraints, social and economic aspects and risks. |
| PO 06 | To understand the basic properties of structural materials, principles and limitations of their use in chemical engineering. |
| PO 07 | To select and use appropriate equipment, tools and methods to solve complex problems of chemical engineering, control and management of technological processes of chemical production. |
| PO 08 | To use modern computer technology, specialized software and information technology to solve complex problems and practical tasks in the field of chemical engineering, in particular, for calculations of equipment and processes of chemical production. |
| PO 09 | To ensure the safety of personnel and the environment during professional activities in the field of chemical engineering. |
| PO 10 | To discuss the results of professional activities with specialists and non-specialists, argue their own position. |
| PO 11 | To communicate fluently on professional issues orally and in writing in the state and foreign languages. |

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| PO 12 | To understand the principles of law and legal principles of professional activity. |
| PO 13 | To understand chemical engineering as a component of modern science and technology, its place in the development of engineering, the Ukrainian state and world culture. |
| PO 14 | To develop project documentation, taking into account the requirements of standards. |
| PO 15 | To substantiate the choice of technological schemes of production on the basis of rational use of raw materials, energy, obtaining quality products, achieving high productivity while solving environmental issues, calculate material and thermal balances of processes, based on them to find costs of raw materials and energy resources. |
| PO 16 | To determine the quality characteristics of plant raw materials, semi-finished and finished products, choose functional chemical excipients. |
| PO 17 | To participate in the development and implementation of projects aimed at optimal management and treatment of industrial waste. |
| PO 18 | To determine the class of toxicity and danger of chemical pollutants according to the parameters of toxicometry, to predict the impact of technological processes and industries on the environment and human health. |
| PO 19 | To assess the state of the environment, to determine the level of impact of the company (production) on the environment, to determine the main pollutants of the company (production). |
| PO 20 | To understand the basic environmental laws, rules and principles of environmental protection and nature management. |
| PO 21 | To make independent decisions at a specific working place in real production conditions in the process of performing various duties. |

| **8 – Resource support for program implementation** | |
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| Staffing | In accordance with the staffing requirements to support educational activities for the respective HE level, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 in the current edition as amended by the Resolution № 365 dated March 24, 2021.<br>Involvement of professional practitioners and lecturers from other higher education institutions in teaching professional-oriented disciplines. Staffing complies with applicable license requirements.<br>The number of scientific and pedagogical employees for the implementation of the educational program – 24, of which those having a scientific degree and academic title – 24. |
| Material-technical support | In accordance with the technological requirements for material-technical support of educational activities of the respective HE level, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 in the current edition as amended by the Resolution № 365 dated March 24, 2021.<br>A specialized laboratory, a complex of laboratories of the department and the auditorium, equipped with technical means of demonstration, including multimedia systems, are available for research.<br>There are agreements with companies, on the basis of which students gain practical experience in the implementation of technologies and solution of environmental problems.<br>There is an option of remote information exchange and interaction with teachers. |

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| Information and educational-methodical support | In accordance with the technological requirements for training-methodological and informational support of education activities of the respective HE level, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 in the current edition as amended by the Resolution № 365 dated March 24, 2021.<br>The use of the library at the department and the Scientific and Technical Library of Igor Sikorsky Kyiv Polytechnic Institute. |
| **9 – Academic mobility** | |
| National credit mobility | Possibility of participation in programs of academic mobility, double diploma programs. |
| International credit mobility | The possibility of participation in the Erasmus+ program, international credit mobility projects. |
| Training of foreign higher education applicants | The possibility of teaching in English in separate academic groups, while Ukrainian is studied as a foreign language; or in Ukrainian in joint groups with Ukrainian applicants. |

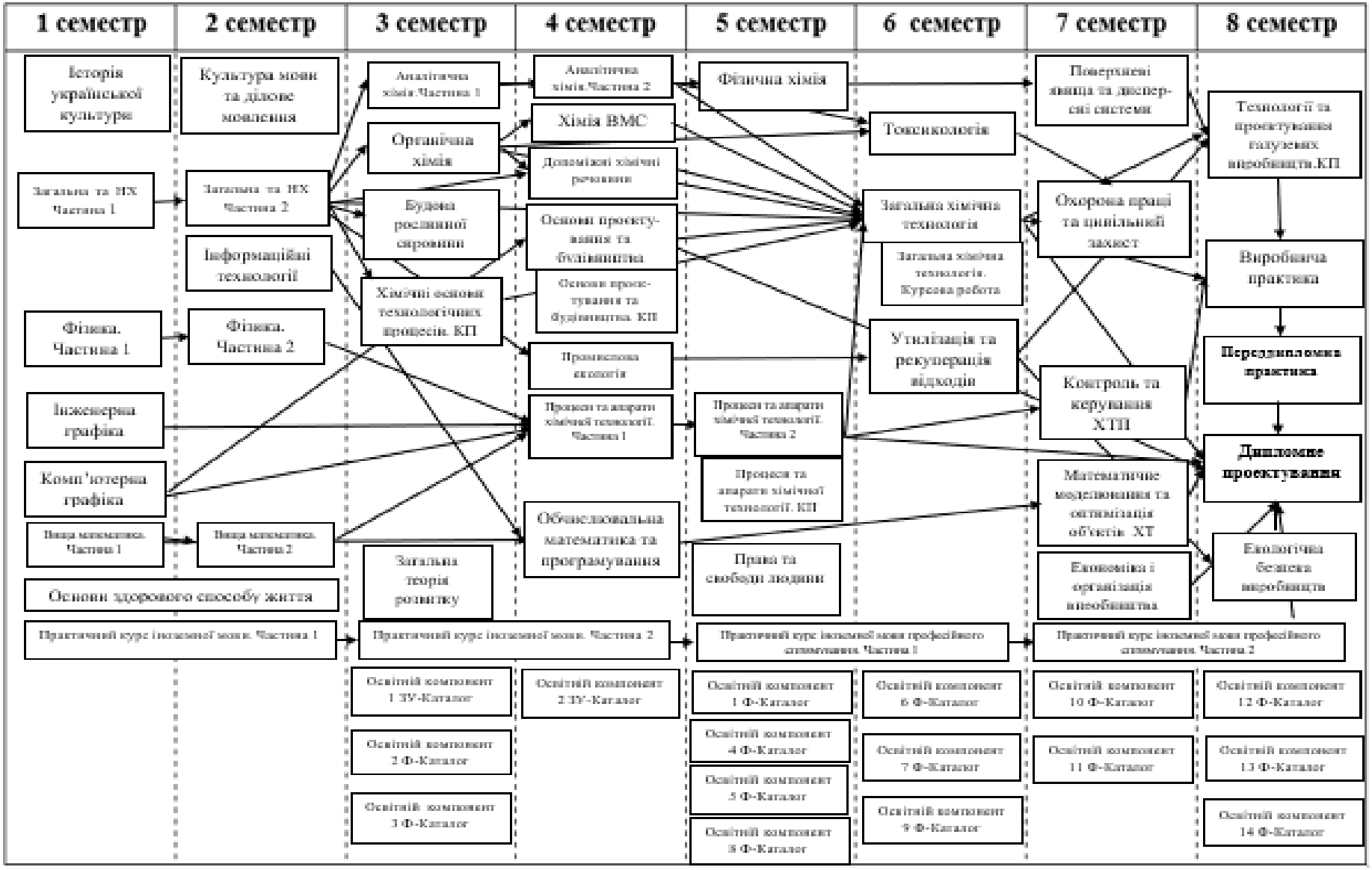
# 2. LIST OF COMPONENTS OF THE EDUCATIONAL PROGRAM

| Code | Components of the educational program (disciplines, course projects (works), practice, qualifying work) | ECTS Credits | Final examination |
|---|---|---|---|
| **1. Compulsory educational components** | | | |
| **1.1. General training cycle** | | | |
| GC 01 | Language Culture and Bussiness Language | 2 | final test |
| GC 02 | History of Ukrainian Culture | 2 | final test |
| GC 03 | General Theory of Development | 2 | final test |
| GC 04 | Industrial Ecology | 2 | final test |
| GC 05 | Human Rights and Freedoms | 2 | final test |
| GC 06 | Economics and Production Engineering | 4 | final test |
| GC 07 | Labour Safety and Civil Defense | 4 | final test |
| GC 08 | Basis of Healthy Lifestyle | 3 | final test |
| GC 09.1 | Practical Course in Foreign Language. Part 1 | 3 | final test |
| GC 09.2 | Practical Course in Foreign Language. Part 2 | 3 | final test |
| GC 10.1 | Practical Course in Foreign Language for Specific Purposes. Part 1 | 3 | final test |
| GC 10.2 | Practical Course in Foreign Language for Specific Purposes. Part 2 | 3 | exam |
| GC 11.1 | Higher Mathematics. Part 1. Linear Algebra and Analytical Geometry. Differential Calculus | 6 | exam |
| GC 11.2 | Higher Mathematics. Part 2. Integral Calculus and Differential Equation | 7 | exam |
| GC 12.1 | Physics. Part 1. Classical Physics | 6 | exam |
| GC 12.2 | Physics. Part 2. Quantum Physics | 7 | exam |
| GC 13.1 | General and Inorganic Chemistry. Part 1. General Chemistry | 7 | exam |

| Code | Components of the educational program (disciplines, course projects (works), practice, qualifying work) | ECTS Credits | Final examination |
|---|---|---|---|
| GC 13.2 | General and Inorganic Chemistry. Part 2. Inorganic Chemistry | 7 | exam |
| GC 14 | Organic Chemistry | 5 | exam |
| **1.2. Vocational training cycle** | | | |
| VC 01 | Engineering Graphics | 3 | final test |
| VC 02 | Computer Graphics | 3 | final test |
| VC 03 | Information Technologies | 4 | final test |
| VC 04.1 | Processes and Equipment of Chemical Technology. Part 1. Heat Processes | 4 | exam |
| VC 04.2 | Processes and Equipment of Chemical Technology. Part 2. Hydromechanical and Mass-Transfer Processes and Equipment of Chemical Technology | 4,5 | exam |
| VC 05 | Course Project in Processes and Equipment of Chemical Technology | 1,5 | final test |
| VC 06 | General Chemical Technology | 5 | exam |
| VC 07 | Course Work in General Chemical Technology | 1 | final test |
| VC 08 | Calculus Mathematics and Programming | 4 | final test |
| VC 09.1 | Analytical Chemistry. Part 1. Qualitative Analysis | 5 | exam |
| VC 09.2 | Analytical Chemistry. Part 2. Quantitative Analysis | 4 | exam |
| VC 10 | Physical Chemistry | 6 | exam |
| VC 11 | Chemistry of Macromolecular Compounds | 4 | final test |
| VC 12 | Surface Phenomena and Disperse Systems | 4,5 | exam |
| VC 13 | Structure of Plant Raw Materials | 5 | exam |
| VC 14 | Auxiliary Chemical Substances | 3 | final test |
| VC 15 | Mathematical Simulation and Optimization of Processes of Chemical Technology | 4 | exam |
| VC 16 | Waste Utilization and Recuperation | 4 | exam |
| VC 17 | Fundamentals of Design and Construction | 4 | exam |
| VC 18 | Course Project in Fundamentals of Design and Construction | 1,5 | final test |
| VC 19 | Toxicology | 5 | exam |
| VC 20 | Monitoring and Control of Chemical Technological Processes | 4 | exam |
| VC 21 | Environmental Safety of Productions | 3 | exam |
| VC 22 | Course Project in Chemical Fundamentals of Technological Processes | 1,5 | final test |
| VC 23 | Course Project in Technologies and Design of Industrial Productions | 1,5 | final test |
| VC 24 | Work Practice | 4 | final test |

| Code | Components of the educational program (disciplines, course projects (works), practice, qualifying work) | ECTS Credits | Final examination |
|---|---|---|---|
| VC 25 | Pre-diploma Practice | 2 | final test |
| VC 26 | Diploma Project | 6 | defense |
| | | | |
| **2. Optional educational components** | | | |
| **2.1. General training cycle** | | | |
| GO 01 | Educational component 1 GU- Catalog | 2 | final test |
| GO 02 | Educational component 2 GU- Catalog | 2 | final test |
| | | | |
| **2.2. Vocational training cycle** | | | |
| VO 01 | Educational component 1 F-Catalog | 4 | final test |
| VO 02 | Educational component 2 F-Catalog | 4 | final test |
| VO 03 | Educational component 3 F-Catalog | 4 | final test |
| VO 04 | Educational component 4 F-Catalog | 4 | final test |
| VO 05 | Educational component 5 F-Catalog | 4 | final test |
| VO 06 | Educational component 6 F-Catalog | 4 | final test |
| VO 07 | Educational component 7 F-Catalog | 4 | final test |
| VO 08 | Educational component 8 F-Catalog | 4 | final test |
| VO 09 | Educational component 9 F-Catalog | 4 | final test |
| VO 10 | Educational component 10 F-Catalog | 4 | final test |
| VO 11 | Educational component 11 F-Catalog | 4 | final test |
| VO 12 | Educational component 12 F-Catalog | 4 | final test |
| VO 13 | Educational component 13 F-Catalog | 4 | final test |
| VO 14 | Educational component 14 F-Catalog | 4 | final test |
| Total in **compulsory components**: | | **180** | |
| Total in **optional components**: | | **60** | |
| Total in educational components **that ensure the acquisition of competencies defined by the SHE** | | **120** | |
| **TOTAL in EDUCATIONAL PROGRAM** | | **240** | |

# 3. STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROGRAM



# 4. FORM OF FINAL EXAMINATION OF HIGHER EDUCATION APPLICANTS

Attestation is carried out in the form of public defense of qualifying work.

The qualifying work must involve the solution of a complex specialized task and/or practical problem of chemical technologies and engineering, which is characterized by complexity and uncertainty of conditions, with the application of theories and methods of chemical engineering.

The qualifying work must be checked for plagiarism.

The qualifying work must be posted on the website of the higher education institution (Electronic Archive of Scientific and Educational Materials of Igor Sikorsky Kyiv Polytechnic Institute (ELAKPI)) or its structural subdivision https://eco-paper.kpi.ua/ (abstract).

# 5. MATRIX OF CORRESPONDENCE OF PROGRAM COMPETENCIES TO THE COMPONENTS OF THE EDUCATIONAL PROGRAM

| | GC 01 | GC 02 | GC 03 | GC 04 | GC 05 | GC 06 | GC 07 | GC 08 | GC 09.1 | GC 09.2 | GC 10.1 | GC 10.2 | GC 11.1 | GC 11.2 | GC 12.1 | GC 12.2 | GC 13.1 | GC 13.2 | GC 14 | VC 01 | VC 02 | VC 03 | VC 04.1 | VC 04.2 | VC 05 | VC 06 | VC 07 | VC 08 | VC 09.1 | VC 09.2 | VC 10 | VC 11 | VC 12 | VC 13 | VC 14 | VC 15 | VC 16 | VC 17 | VC 18 | VC 19 | VC 20 | VC 21 | VC 22 | VC 23 | VC 24 | VC 25 | VC 26 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C01 | | | | | | | | | | | | | + | + | + | + | + | + | + | | | | | | | + | | | + | + | + | + | + | | | + | | | | | | | | | | |
| C02 | + | + | + | | + | + | | + | | | + | + | + | + | | | + | + | + | + | | + | + | + | + | + | + | + | + | + | + | + | + | | | + | | + | + | | | | + | + | + | + | + |
| C03 | | | + | | | | + | | | | | | | | + | + | | + | + | | | | + | + | | + | | | | | | | | | | | | | | + | | | | + | + | + | + |
| C04 | + | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | + | + | + |
| C05 | | | | | | | | | + | + | + | + | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | + | + |
| C06 | | | | + | | | | | | | | | | | | | | | | | | | | | | + | | | | | | | | | | | + | | | | | + | | | | | |
| C07 | | | | | + | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | + |
| C08 | | + | + | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | + |
| C09 | | | | | | | | | | | | | + | + | + | + | + | + | + | | | | | | | | | | + | + | + | + | + | + | | | | | | | | | | | | |
| C10 | | | | | | | | | | | | | | | | | | | + | | | | | | | + | | | | | | | | | | + | + | + | + | | | | | | | | |
| C11 | | | | + | + | | + | | | | | | | | | | | | + | | | | + | + | | + | + | | | | | | | | | + | | | | + | + | | | | + | + | |
| C12 | | | | | | | | | | | | | | | | | | | | + | | | + | + | + | + | + | | | | | | | | | | | | | | | | | | | | + |
| C13 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | + | | | | | | |
| C14 | | | | | | | | | | | | | | | | | | | | | + | + | | | | | | + | | | | | | | | + | | | | | | | | | | | + |
| C15 | | | | | | + | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | + |
| C16 | | | | + | | | + | | | | | | | | | | | | | + | | | + | + | + | | | | | | | | | | | | | + | | | | | | + | + | + |
| C17 | | | | | | | | | | | | | | | | | | | | + | + | | + | + | + | | | | | | | | | | | | | + | + | | | | | | | + |
| C18 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | + | + | + | + | + | | + | | | | | | | | | + | + | + |
| C19 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | + | + | | | | | | | | | | + | | | |
| C20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | + | | | | |
| C21 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | + | | | + | | | + | + | | + | + | + |
| C22 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | + | | | | | | | | | | | + |

## 6. MATRIX OF PROVIDING OF PROGRAM LEARNING OUTCOMES BY RELEVANT COMPONENTS OF THE EDUCATIONAL PROGRAM

| | GC 01 | GC 02 | GC 03 | GC 04 | GC 05 | GC 06 | GC 07 | GC 08 | GC 09.1 | GC 09.2 | GC 10.1 | GC 10.2 | GC 11.1 | GC 11.2 | GC 12.1 | GC 12.2 | GC 13.1 | GC 13.2 | GC 14 | VC 01 | VC 02 | VC 03 | VC 04.1 | VC 04.2 | VC 05 | VC 06 | VC 07 | VC 08 | VC 09.1 | VC 09.2 | | VC 10 | VC 11 | VC 12 | VC 13 | VC 14 | VC 15 | VC 16 | VC 17 | VC 18 | VC 19 | VC 20 | VC 21 | VC 22 | VC 23 | VC 24 | VC 25 | П VC 26 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PO 01 | | | | | | | | | | | | | + | + | + | + | + | + | + | | | | | | | | + | + | + | | + | + | + | | | | | | | | | | | | | |
| PO 02 | | | | | | | | | | | | | | | | | + | + | + | | | | + | + | | + | | | + | + | | + | + | | | + | | | | | | + | + | + | + | + |
| PO 03 | | | | | | | | | | | | | | | | | | + | + | | | | + | + | + | + | | | | | | + | + | + | | | | | | | | | + | | | | + |
| PO 04 | | | | | | | | | | | | | | | | | + | + | + | | | | | | | | | | + | + | | + | + | + | | + | | | | | | | | | | |
| PO 05 | | | | + | + | + | + | | | | | | | | | | | | + | | | | + | + | + | + | + | | | | | | + | | + | | | + | + | | | | + | + | | | + |
| PO 06 | | | | | | | | | | | | | | | | | | | | + | | | + | + | + | + | | | | | | | | | | | | | | | | | | + | | | |
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