

**MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
LVIV POLYTECHNIC NATIONAL UNIVERSITY**

"APPROVED"

Rector of

Lviv Polytechnic National University

_____ /Bobalo Yu.Ya./

" ____ " _____ 2022

EDUCATIONAL AND SCIENTIFIC PROGRAM

third (educational and scientific) level of higher education

in specialty 161 Chemical technologies and engineering

field of knowledge 16 Chemical and bioengineering

Qualification: Doctor of Philosophy in Chemical Technology and Engineering

Considered and approved

Academic Council of the University

(Protocol No. ____

from " __ " _____ 2022)

Developed by the project team in the specialty 161 Chemical technologies and engineering, consisting of:

Head:

V. M. Head of the Department of Chemical Engineering, DSc, Prof.

Atamanyuk

Members:

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Hrynyshyn O.B. Professor of the Department of Chemical Technology of Oil and Gas Processing, DSc, Prof.

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Danilyuk R.V. Postgraduate student of the 3rd year of study, specialty 161 Chemical technologies and engineering

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Zagray A.I. Postgraduate student of the 3rd year of study, specialty 161 Chemical technologies and engineering

Bodak P.M. Head of "Institute of Mining and Chemical Industry" LLC

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Kiyayeva S.S. Student of the Institute of Chemistry and Chemical Technologies

Kuzminchuk T.A. Student of the Institute of Chemistry and Chemical Technologies

Guarantor _____ Atamanyuk V.M., DSc, Prof.

Approved and put into effect by the Order of Rector of Lviv Polytechnic National University from " ____ " _____ 2022 No. _____.

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LETTER OF AGREEMENT
educational and scientific program

The level of higher education	the third (educational and scientific)
The branch of knowledge	16 <i>Chemical and bioengineering</i>
The speciality	161 <i>Chemical technologies and engineering</i>
The qualification	The Doctor of Philosophy

APPROVED

Scientific and methodical commission of the specialty 161 *Chemical technologies and engineering*

Protocol № _____

since «_____» _____ 2022 p.

The head of the EMC of the specialty 161 *Chemical technologies and engineering*

_____ Dzinyak B.O.

«_____» _____ 2022 p.

Director of Institute of Chemistry and Chemical Technologies

_____ Skorokhoda V.Y.

«_____» _____ 2022 p.

RECOMMENDED

Scientific and methodological council of the university

Protocol № _____

since «_____» _____ 2022 p.

The head of the EMD

_____ Zagorodniy A.G.

AGREED

The head of the educational and methodical department

_____ Sviridov V.M.

«_____» _____ 2022 p.

Vice-Rector for Scientific Research of Lviv Polytechnic National University

_____ Demydov I.V.

«_____» _____ 2022 p.

Vice-Rector for Graduate Education of Lviv Polytechnic National University

_____ Davydchak O.R.

«_____» _____ 2022 p.

I. EDUCATIONAL COMPONENT OF THE EDUCATIONAL AND SCIENTIFIC PROGRAM
1. THE PROFILE OF THE DOCTOR OF PHILOSOPHY PROGRAM IN CHEMICAL TECHNOLOGY AND ENGINEERING

1 – General information	
1	2
Full name of the institution of higher education	Lviv Polytechnic National University
The full title of the qualification in the original language	Doctor of Philosophy in Chemical and Bioengineering by Speciality of Chemical Technology and Engineering
The official name of the educational and scientific program	Chemical Technology and Engineering
Type of diploma and scope of the educational program	Diploma of Doctor of Philosophy, single, 43 ECTS credits of the educational component of the educational and scientific program, the term of the educational component of the educational and scientific program - 2 years
Cycle/level	NRK of Ukraine – 8th level, FQ-EHEA – third cycle, EQF-LLL – 8th level
Prerequisites	Level of higher education "Master"
Language(s) of instruction	Ukrainian
Basic concepts and their definitions	The educational and scientific program uses the main concepts and their definitions in accordance with the Law of Ukraine "On Higher Education" dated 07/01/2014 No. 1556-VII as amended, the Law of Ukraine "On Scientific and Scientific and Technical Activities" dated 11/26/2015 y. No. 848-VIII with amendments and additions, the Procedure for training applicants for the degree of Doctor of Philosophy and Doctor of Sciences in higher educational institutions (scientific institutions), approved by Resolution of the Cabinet of Ministers dated March 23, 2016 No. 261, Regulations on the Accreditation of Educational Programs, according to which higher education applicants are trained, approved by the Order of the Ministry of Education and Science of Ukraine dated July 11, 2019 No. 977.
2 – The aim of the educational program	
	Provide theoretical knowledge and practical abilities and skills for solving complex problems in the field of chemical technology and engineering, conducting scientific, research and innovation activities, as well as implementing the obtained results.
3 - Characteristics of the educational program	
Subject area (field of knowledge, speciality)	Branch of knowledge 16 <i>Chemical and bioengineering</i> , speciality 161 <i>Chemical technologies and engineering</i>
Orientation of the educational program	The educational and scientific program is aimed at relevant aspects of the specialty, within which a further scientific and scientific-pedagogical career is possible. Theoretical and methodological, scientific and applied foundations of chemical technologies; principles of optimization of technological processes to ensure a high level of quality of final products, resource conservation of production; patterns of innovative development of the theory and practice of chemical

	technologies; methodological principles of scientific, scientific-technical and scientific-pedagogical activities.
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1	2
The main focus of the educational program and specialization	The scientific component of the educational and scientific program is determined by the individual study plan of the graduate student. The educational and scientific program covers a wide range of modern innovative vectors of the development of the theory and practice of chemical technologies, which forms an updated theoretical and applied base for conducting scientific research.
Accreditation of the program	Decision NAHEQA of protocol No. 24 (11) dated 12/15/2020 Certificate No. 833. The validity period of the certificate of accreditation of the educational program is until 01.07.2026

4 – Eligibility of graduates of the educational program to employment and further education

Suitability for employment	The working places in public and private research institutes of the National Academy of Sciences of Ukraine, higher educational institutions of the Ministry of Education and Culture of Ukraine as teachers and researchers, scientific centers and high-tech companies of the chemical and technological profile, enterprises of the chemical production sector and related industries, at enterprises and organizations of various types of activities and forms of ownership in management positions.
Further education	The advanced training in scientific research institutes of the National Academy of Sciences of Ukraine, leading universities and research centers of chemical production, obtaining the scientific degree of Doctor of Sciences..

5 – Teaching and assessment

Teaching and learning	A combination of lectures and practical classes, a pedagogical workshop, consulting with a scientific supervisor, a scientific-pedagogical community with independent scientific-educational work.
Assessment	Exams, tests, oral presentations, dissertation defense.

6 – Software competencies

Integral competence	The ability to solve complex problems in the field of chemical technology and engineering, to carry out research and innovation activities that involve a deep rethinking of existing and the creation of new integral knowledge, scientific principles, as well as the practical implementation of the obtained results at chemical industry enterprises.
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General competences	<ol style="list-style-type: none"> 1) the systematic knowledge of modern methods of conducting research in the field of chemical technologies and engineering and in related fields; 2) a critical analysis, evaluation and synthesis of new ideas; 3) the ability to effectively communicate with the wider scientific community in an international context and the public on topical issues of chemical technologies and engineering and related fields; 4) the ability to self-develop and self-improve during life, responsibility for teaching others; 5) the social responsibility for the results of strategic decision-making; 6) an initiation of original research and innovation complex projects; 7) a leadership and the ability to work autonomously and in a team during project implementation.
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1	2
Special (professional) competences (SC)	<ol style="list-style-type: none"> 1) the knowledge of modern development trends from the most important scientific achievements in the field of chemistry, chemical technologies and engineering, chemical materials science and related fields; 2) the systematic knowledge and understanding of modern scientific theories and methods and the ability to effectively apply them for the synthesis of new chemical compounds, technological processes, waste-free chemical technologies and chemical equipment, energy saving and environmental safety; 3) the ability to effectively apply modern methods of analysis, numerical modeling, to perform experimental studies with objects of chemical technologies in laboratory and industrial conditions; 4) the ability to integrate knowledge from other disciplines, apply the latest systematic approach, take into account non-technical aspects when conducting experimental research and solving engineering problems; 5) the ability to develop and implement scientific and scientific-technical projects, including the results of own research, which make it possible to rethink the generally accepted provisions about the mechanisms and principles of chemical and physico-chemical transformations of substances, the transformation of energy into them, and to create new knowledge and scientific principles; 6) the ability to argue the choice of a method for solving a specialized problem, critically evaluate the results obtained and defend the decisions made with arguments.
7 – Program learning outcomes	

PO01. The ability to demonstrate systematic knowledge and skills of modern research methods in the field of chemical technology and engineering, chemical materials science and related industries;

PO02. The ability to demonstrate in-depth theoretical knowledge in the chosen field of scientific research;

PO03. An understanding of modern technologies of chemical production and trends in their development;

PO04 The ability to demonstrate understanding of the impact of technical solutions in a societal, economic and social context;

PO05 The search, analyze and critically evaluate scientific and scientific and technical information from various sources;

PO06 The apply knowledge and understanding to solve problems of synthesis and analysis of elements and systems characteristic of the chosen field of scientific research;

PO07 an investigate and model phenomena and processes in complex chemical and physicochemical systems;

PO08. The apply a systematic approach, integrating knowledge from other disciplines and taking into account non-technical aspects, when solving theoretical and applied problems of the chosen field of scientific research;

PO09. The combine theory and practice, as well as make decisions and develop a strategy for solving scientific and applied problems, taking into account universal human values, public, state and industrial interests, current legislation;

PO10. The effectively work both individually and as part of a team, including international partnerships;

PO11. The independently perform experimental research at a modern level and apply research skills;

PO12. Assess the expediency and possibility of applying innovative processes in chemical technologies and engineering, chemical materials science and related fields;

PO13. Argue the choice of methods for solving a scientific and applied problem, critically evaluate the obtained results and defend the decisions made.

PO14. The ability to communicate effectively at international professional and social levels;

PO15. The ability to present and discuss the obtained results at the international level and transfer the acquired knowledge;

PO16. The ability to adapt to new conditions, make independent decisions and initiate original research and innovation complex projects, including international;

PO17. The ability to realize the need for lifelong learning in order to deepen the acquired and acquire new professional knowledge, taking into account the trends in the development of science and technology and, first of all, chemistry, chemical technologies and engineering, related fields;

PO18. The ability to take responsibility for the work performed and achieve the set goal in compliance with the requirements of professional ethics and current legislation.

8 – Resource support for program implementation

Specific characteristics of personnel support	100% of scientific and pedagogical workers involved in teaching professionally oriented disciplines, have scientific degrees in their specialty and are recognized professionals with experience in research, management or innovative work in their specialty.
Specific characteristics of material and technical support	The using of modern equipment of leading chemical and chemical-technological companies, in particular BASF, DYCKEROFF UKRAIN, FUNDABAC-Filtration Systems, HENKEL, LUKOIL, LAFARGE.
Specific characteristics of informational and methodical support	The use of the virtual learning environment of the National University "Lviv Polytechnic" and author's developments of the teaching staff.

9 – Academic mobility

(regulated by CMU Resolution No. 579 "On Approval of the Regulation on the Procedure for Realizing the Right to Academic Mobility" dated August 12, 2015)

National credit mobility	On the basis of bilateral agreements between Lviv Polytechnic National University, universities of Ukraine, institutes of the National Academy of Sciences of Ukraine.
International credit mobility	As part of the EU Erasmus + program on the basis of bilateral agreements between Lviv Polytechnic National University and educational institutions of partner countries
Education of foreign students of higher education	It is possible, after studying the Ukrainian.

**2. Distribution of content
of the educational component of the educational and scientific program
by component groups and preparation cycles**

№ in/or.	Training cycle	The volume of the educational load of the student of higher education (credits / %)		
		Common components of the educational and professional program	Elective components of the educational and professional program	Total for the entire period of study
1.	Cycle of disciplines that form general scientific competences and universal skills of the researcher	21/49	3/7	24/56
2.	Cycle of disciplines forming professional competences	10/23	6/14	16/37
3.	Cycle of subjects of free choice of a graduate student	–	3/7	3/7
Total for the entire period of study		31/72	12/28	43/100

3. List of components of the educational component of the educational and scientific program

Code n/a	Components of the educational component	Number of credits	Final control form	Competences provided for by Resolution 261 of 23.03.2016. (with changes from 03.04.2019)
1	2	3	4	5
1. Mandatory components of the educational component				
<i>1.1. Cycle of disciplines that form general scientific competences and universal skills of the researcher</i>				
<i>Cycle of disciplines that form general scientific competences and universal skills of the researcher</i>				
MD1.1.	Philosophy and methodology of science	3	exam	Mastering general scientific (philosophical) competences aimed at forming a systematic scientific outlook, professional ethics and a general cultural outlook; application of modern information technologies in scientific activities (work with NMBD, automatic formation of links to literary sources)
MD 1.2.	Foreign Language for Academic Purposes, Part 1	4	test	Acquisition of linguistic competences sufficient to present and discuss the results of one's scientific work in a foreign language in oral and written form, as well as to fully understand foreign language scientific texts in the relevant specialty, use of modern information technologies (presentation of scientific results).
MD 1.3.	Foreign Language for Academic Purposes, Part 2	4	exam	
MD 1.4.	Professional pedagogy	3	test	Acquisition of universal skills of a researcher, in particular, organization and conduct of training sessions, use of modern information technologies (work with VLE, Microsoft Teams, Zoom, etc.)
MD 1.6.	Academic entrepreneurship	4	test	Acquisition of universal skills of a researcher, in particular, oral and written presentation of the results of one's own research in Ukrainian, management of scientific projects and/or preparation of proposals for financing scientific research, registration of intellectual property rights, application of modern information technologies.
MD 1.7.	Pedagogical practice	3	test	Acquisition of universal skills of a researcher, in particular, organization and conduct of training sessions, use of modern information technologies (working with VLE, Microsoft Teams, Zoom, etc.).
Total per cycle:		21		

1	2	3	4	5
<i>1.1. Cycle of disciplines forming professional competences</i>				
MD 2.1	Scientific foundations of theoretical research and modeling of chemical and technological processes	4	exam	Acquiring in-depth knowledge of the specialty in which the graduate student conducts research, in particular mastering the main concepts, understanding theoretical and practical problems, the history of development and the current state of scientific knowledge in the chosen specialty, mastering the terminology of the researched scientific direction in the amount of ECTS credits in accordance with the standard of higher education.
MD 2.2.	Research seminar in the field of chemical technology and engineering	3	test	
MD 2.3.	Research methods in chemical technology and engineering	3	test	
Total per cycle:		10		
2. Optional components of the educational component**				
<i>2.1. Cycle of disciplines that form general scientific competences and universal skills of the researcher</i>				
OD1.1	Business Foreign Language	3	diff. test	Acquisition of universal skills of a researcher, in particular, oral and written presentation of the results of one's own research in Ukrainian, management of scientific projects and/or preparation of proposals for financing scientific research, registration of intellectual property rights, application of modern information technologies. Acquisition of linguistic competences sufficient to present and discuss the results of one's scientific work in a foreign language in oral and written form, as well as to fully understand foreign language scientific texts in the relevant specialty, use of modern information technologies (presentation of scientific results). Mastering general scientific (philosophical) competences aimed at forming a systematic scientific outlook, professional ethics and a general cultural outlook; application of modern information technologies in scientific activities (work with NMBD, automatic formation of links to literary sources) Acquisition of universal skills of a researcher, in particular, organization and conduct of training sessions, use of modern information technologies (working with VLE, Microsoft Teams, Zoom, etc.).
OD1.2	Psychology of creativity and invention	3	diff. test	
OD1.3	Management of scientific projects	3	diff. test	
OD1.4	Technology of registration of grant applications and patent rights	3	diff. test	
OD1.5	Rhetoric	3	diff. test	
OD1.6	Modern inventions in research activities	3	diff. test	
OD1.7	Open scientific practices	3	diff. test	
OD1.8	Academic integrity and quality of education	3	diff. test	
OD1.9	Methodology of preparation of scientific publications	3	diff. test	
OD1.10	Quality of higher education (formation of internal quality assurance systems)	3	diff. test	
Total per cycle:		3		

1	2	3	4	5
<i>2.2. Cycle of disciplines forming professional competences</i>				
OD2.1	Study of the kinetics of complex chemical reactions	3	exam	Acquiring in-depth knowledge of the specialty in which the graduate student conducts research, in particular, mastering the main concepts, understanding theoretical and practical problems, the history of development and the current state of scientific knowledge in the chosen specialty, mastering the terminology of the researched scientific direction.
OD2.2	Development of the theory of chemical reactions: mechanism, kinetics, thermodynamics	3	exam	
OD2.3	Scientific aspects of improving existing and creating new technological processes of organic synthesis	3	exam	
OD2.4	Computer modeling of hydromechanical processes in chemical technology and engineering	3	exam	
OD2.5	Exergetic analysis of chemical and technological systems	3	exam	
OD2.6	Theoretical foundations of stationary and fluidized bed hydrodynamics	3	exam	
OD2.7	Scientific bases of the processes of processing oil residues and spent oil products	3	exam	
OD2.8	Methods of research, modeling and calculations of kinetic and hydrodynamic parameters of processes of processing hydrocarbon mixtures	3	exam	
OD2.9	Scientific basis of anti-corrosion protection of equipment of oil refineries	3	exam	

1	2	3	4	5
OD2.10	The technology of obtaining hydrogels based on natural and synthetic polymers for use in the food and cosmetic industry	3	exam	<p>Acquiring in-depth knowledge of the specialty in which the graduate student conducts research, in particular, mastering the main concepts, understanding theoretical and practical problems, the history of development and the current state of scientific knowledge in the chosen specialty, mastering the terminology of the researched scientific direction.</p>
OD2.11	Electrochemical and hydrogen energy	3	exam	
OD2.12	The technology of obtaining colloidal systems of various types as the basis of cosmetic products	3	exam	
OD2.13	The technology of obtaining emulsifiers and stabilizers and their use in the food and cosmetic industry	3	exam	
OD2.14	Scientific basis of creation of polymer composites and nanocomposites	3	exam	
OD2.15	Modern trends in the secondary processing of polymer waste	3	exam	
OD2.16	Theoretical bases of the technology of obtaining adhesive, varnish and film materials	3	exam	
OD2.17	Electrochemistry of nanomaterials	3	exam	
OD2.18	Promising water conditioning technologies	3	exam	
OD2.19	Chemical technology of silicates	3	exam	
OD2.20	Crystal chemistry of silicates	3	exam	
OD2.21	Physico-chemical methods of analysis of silicates	3	exam	
OD2.22	Catalysis in chemistry and chemical technology	3	exam	
OD2.23	Numerical modeling of chemical technology processes	3	exam	
OD2.24	Industrial petrochemical processes	3	exam	

1	2	3	4	5
OD2.25.	Physico-chemical processes in technology of polymers and composites	3	exam	Acquiring in-depth knowledge of the specialty in which the graduate student conducts research, in particular, mastering the main concepts, understanding theoretical and practical problems, the history of development and the current state of scientific knowledge in the chosen specialty, mastering the terminology of the researched scientific direction.
OD2.26	Innovative processes in chemical technologies	3	exam	
Total per cycle:		6 (3+3)		
3. Disciplines of the graduate student's free choice **				
OD3.1	Discipline of the graduate student's free choice**	3	diff. test	Acquiring skills of critical analysis, evaluation and synthesis of new and complex ideas
Total per cycle:		3		
TOTAL		43		

Note: * - pedagogical practicum can take place in the II or III year of study;

** - a graduate student can choose disciplines from point 2, point 3 (selective and free choice), while the share of these subjects must be at least 25% of the total number of ECTS credits.

4. Matrix of correspondence of program competencies to educational components

	MD1.1.	MD1.2.	MD1.3.	MD1.4.	MD1.5.	MD1.6.	MD1.7.	MD2.1.	MD2.2.	MD2.3.	OD1.1.	OD1.2.	OD1.3.	OD1.4.	OD1.5.	OD1.6.	OD1.7.	OD1.8.	OD1.9.	OD1.10.	OD2.1.	OD2.2.	OD2.3.	OD2.4.	OD2.5.	OD2.6.	OD2.7.	OD2.8.	OD2.9.	OD2.10.	OD2.11.	OD2.12.	OD2.13.	OD2.14.	OD2.15.	OD2.16.	OD2.17.	OD2.18.	OD2.19.	OD2.20.	OD2.21.	OD2.22.	OD2.23.	OD2.24.	OD2.25.	OD2.26.																	
INC					•			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•															
GC1					•			•		•	•		•	•		•			•	•		•		•	•	•	•	•	•	•	•	•				•	•		•	•	•	•	•	•	•	•	•	•															
GC2	•				•						•		•	•		•				•				•			•						•				•	•				•	•			•	•	•	•														
GC3		•	•	•						•	•		•	•	•	•	•	•	•	•	•		•									•			•					•					•	•	•	•	•	•													
GC4	•	•	•	•	•	•	•				•		•	•	•	•	•	•	•	•	•	•		•								•	•	•	•	•		•	•					•	•			•	•	•	•												
GC5	•						•				•	•	•	•	•		•				•																					•							•	•	•	•											
GC6	•				•	•				•	•	•	•	•	•	•	•	•	•	•	•			•	•	•	•	•				•					•	•					•	•	•	•	•	•	•	•	•												
GC7	•					•	•				•		•	•	•	•	•	•	•	•	•																						•							•	•	•	•										
PC1								•	•	•												•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•											
PC2					•	•		•		•															•	•	•	•	•	•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•	•	•	•										
PC3		•	•		•	•			•		•			•		•				•					•	•	•	•	•	•	•	•	•	•	•	•	•	•				•	•				•	•	•	•	•	•	•	•									
PC4				•			•	•	•	•		•										•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•							
PC5				•		•		•				•		•		•				•		•	•	•	•				•	•	•																							•	•	•	•	•					
PC6				•		•	•							•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

Legend: MDi – mandatory discipline, ODi – optional discipline, i – discipline number in the list of components of the educational component, INC – integral competence, GC – general competence, PCj – professional (special) competence, j – competency number in the list of competencies of the educational component.

**5. Matrix of provision of software learning outcomes with relevant components
educational component**

	MD1.1.	MD1.2.	MD1.3.	MD1.4.	MD1.5.	MD1.6.	MD1.7.	MD2.1.	MD2.2.	MD2.3.	OD1.1.	OD1.2.	OD1.3.	OD1.4.	OD1.5.	OD1.6.	OD1.7.	OD1.8.	OD1.9.	OD1.10.	OD2.1.	OD2.2.	OD2.3.	OD2.4.	OD2.5.	OD2.6.	OD2.7.	OD2.8.	OD2.9.	OD2.10.	OD2.11.	OD2.12.	OD2.13.	OD2.14.	OD2.15.	OD2.16.	OD2.17.	OD2.18.	OD2.19.	OD2.20.	OD2.21.	OD2.22.	OD2.23.	OD2.24.	OD2.25.	OD2.26.												
PR01										•	•		•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•											
PR02					•					•	•		•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•									
PR03										•	•		•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•							
PR04					•						•		•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•							
PR05	•	•	•	•	•		•	•	•	•	•		•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•							
PR06	•				•						•		•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•							
PR07											•		•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•						
PR08					•						•		•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•					
PR09	•			•	•	•	•	•	•																																																	
PR10	•			•	•	•	•	•	•																																																	
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PR12						•				•	•		•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•				
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PR15	•	•	•	•	•		•	•	•	•		•					•																																									
PR16	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			
PR17	•	•	•	•	•		•	•	•	•	•		•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
PR18	•	•	•	•	•		•	•	•	•	•		•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

Legend: MDi – mandatory discipline, ODi – optional discipline, i – discipline number in the list of components of the educational component, KNm – program results (knowledge), SKm – program outcomes (skills), m – program result number in the list of program results of the educational component.

II. The scientific component of the educational and scientific program

A year of training	The content of the graduate student's research work	Form of control
1 year	<p>Selection and justification of the topic of one's own scientific research, determination of the content, deadlines and scope of scientific works; selection and justification of the methodology of conducting one's own scientific research, carrying out a review and analysis of existing views and approaches developed in modern science in the chosen direction.</p> <p>Preparation and publication of at least 1 article in specialized scientific publications (domestic or foreign) on the topic of research; participation in scientific and practical conferences (seminars) with the publication of abstracts of reports.</p>	<p>Approval of the graduate student's individual work plan by the academic council of the institute, reporting on the progress of the graduate student's individual plan twice a year at the cathedral scientific seminar.</p>
2 year	<p>Under the guidance of a scientific supervisor, conducting one's own scientific research, which involves solving research tasks by applying a complex of theoretical and empirical methods. Preparation and publication of at least 1 article in specialized scientific publications (domestic or foreign) on the topic of research; participation in scientific and practical conferences (seminars) with the publication of abstracts of reports.</p>	<p>Reporting on the progress of the graduate student's individual plan twice a year at the cathedral scientific seminar.</p>
3 year	<p>Analysis and generalization of the obtained results of own scientific research; substantiation of the scientific novelty of the obtained results, their theoretical and/or practical significance. Preparation and publication of at least 1 article in specialized scientific publications on the topic of research; participation in scientific and practical conferences (seminars) with the publication of report abstracts.</p>	<p>Reporting on the progress of the graduate student's individual plan twice a year at the cathedral scientific seminar.</p>

4 year	Designing the scientific achievements of the graduate student in the form of a dissertation, summarizing the completeness of the coverage of the results of the dissertation in scientific articles in accordance with current requirements. Implementation of the obtained results and receipt of supporting documents. Submission of documents for the preliminary examination of the dissertation. Preparation of a scientific report for graduation certification (dissertation defense).	Providing a conclusion on the scientific novelty, theoretical and practical significance of the results of the dissertation. Presentation of the results of the completed dissertation work at the extended cathedral scientific seminar. Submission of a dissertation to a specialized academic council.
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The scientific component of the educational-scientific program involves the post-graduate student conducting his own scientific research under the guidance of one or two academic supervisors and the preparation of his results in the form of a dissertation.

The scientific component of the educational and scientific program is drawn up in the form of an individual plan of scientific work of a postgraduate student and is an integral part of the postgraduate curriculum.

Dissertation for the degree of Doctor of Philosophy is an independent comprehensive study that offers a solution to an actual scientific problem in the specialty *161 Chemical Technologies and Engineering*, the results of which constitute an original contribution to the sum of knowledge in the specialty *161 Chemical Technologies and Engineering* and are published in relevant publications.

The dissertation should not contain academic plagiarism or falsification. The dissertation and its abstract must be posted on the website of the higher education institution (scientific institution). The minimum volume of the main text of the dissertation should be at least 4-5 author's sheets. The dissertation must meet other requirements established by law.

Preparation and publication of scientific articles, speeches at scientific conferences, participation in scientific seminars, round tables, symposia are an integral part of the scientific component of the postgraduate educational and scientific program.

Topics of scientific research in specialty *161 Chemical technologies and engineering*:

1. Heat and mass transfer in systems with a solid phase.
2. Separation of heterogeneous systems.
3. Numerical modeling of chemical engineering processes.
4. Development of methods for the synthesis of new surface-active substances for sanitary-hygienic and cosmetic products.

5. Synthesis and research of filled chitosan hydrogels for immobilization of lipophilic aromatic substances.
6. Synthesis of hydrogel matrices with bound metal ions for quality control of food products.
7. Formation of natural-synthetic composites based on natural gums as bioactive ingredients of cosmetics
8. Synthesis of derivatives of natural amino acids for the production of perfumery and cosmetic products.
9. Research of the processes of complex processing of sulfur and potassium raw materials, waste of non-ferrous and rare metals with the development of environmentally friendly, resource-saving technologies of mineral fertilizers, salts, special types of sulfur, metals and their compounds, metal powders and other products.
10. Deposition of metals on the surface of magnesium and aluminum by galvanic substitution.
11. Electrochemistry of nanostructured metals and bimetals
12. Development of technologies for new products of organic synthesis.
13. Development of homogeneous and heterogeneous catalytic processes for the transformation of organic substances.
14. Development of methods of waste utilization and processing of by-products of organic synthesis production.
15. Development of technological processes for the production of organic products using various types of energy.
16. Development of combined technological processes for the production of products of organic synthesis.
17. Analysis, synthesis and optimization of chemical and technological schemes of production of organic products.
18. Development of technologies and equipment for purification and conditioning of natural and wastewater.
19. Development of methods of intensification of natural and wastewater treatment processes
20. Scientific basis of obtaining functionalized highly hydrophilic polymers, hydrogels and nanocomposites and formation of products with special properties
21. Development of technological and physico-chemical bases for obtaining, modifying and processing polymers and (nano)composites based on them
22. Scientific bases of the technology of synthesis and processing of special purpose polymers
23. Study of the composition and properties of oil and oil products.
24. Study of thermal and thermocatalytic processes of processing oil fractions and residues.
25. Development of methods for obtaining high-quality bituminous materials.
26. Development of methods for obtaining modified bitumen and bitumen emulsions.
27. Preparation of bitumen-polymer mixtures using reactive oligomers.

28. Development of methods of regeneration of used oils and disposal of hydrocarbon waste.
29. Development of methods of oxidation purification of hydrocarbon fuels.
30. Obtaining chemical reagents to protect oil refining and oil production equipment from corrosion.
31. Development of the physico-chemical foundations of the latest energy-saving technologies for obtaining new and improving the operational characteristics of existing refractory non-metallic and silicate materials.
32. Development of physico-chemical bases of sol-gel technology of functional ceramic powders
33. Improvement of technological bases of liquid-phase synthesis of oxide ceramic powders and processes of their chemical modification
34. Development of sol-gel glass coating technology
35. Development of physico-chemical bases of directional regulation of the structure and phase composition of ceramic stone in order to improve the production technology of construction and functional ceramics
36. Development of an energy-saving method of tempering sheet glass
37. Development of methods for scratching silicate materials based on aluminosilicate systems
38. Development of compositions of composite binders based on gypsum, lime, cement.
39. Development of compositions and improvement of technology of autoclaved and non-autoclaved aerated concrete.

III. Attestation of postgraduate students

Attestation of applicants for higher education with the degree of doctor of philosophy is carried out by a specialized scientific council, permanently active or formed for a one-time defense, on the basis of a public defense of scientific achievements in the form of a dissertation.

A mandatory condition for admission to the defense is the successful completion of the graduate student's individual study plan. The state of readiness of the graduate thesis for defense is determined by the supervisor (or by consensus decision of two supervisors).

To prevent non-compliance with the norms and rules of academic integrity, the University uses a set of preventive measures, in particular, expert assessment and (or) technical verification (with the help of specialized software tools) regarding signs of academic plagiarism in dissertation research prepared for defense, monographs, scientific articles, etc.

Candidates of higher education for the degree doctor of philosophy defend their dissertations, mainly, in a one-time specialized academic council for the relevant specialty, which is formed in the higher educational institution where the graduate student was trained. The academic council of a higher educational institution has the right to submit documents to the National agency for quality assurance of higher education for the accreditation of a specialized academic council formed for a one-

time defense, or to apply to another higher educational institution where a permanent specialized academic council in the relevant specialty operates.

IV. Characteristics of the system of internal quality assurance of the training of the third-level higher education applicant

The system of internal assurance of the quality of higher education by a higher educational institution consists of the following procedures and measures provided for by the Law of Ukraine "On higher education":

- 1) determination of the principles and procedures for ensuring the quality of higher education;
- 2) monitoring and periodic review of educational programs;
- 3) annual assessment of Ph.D. degree holders, scientific and pedagogical workers of a higher educational institution and regular publication of the results of such assessments on the official website of the higher educational institution, on information stands, etc.;
- 4) provision of advanced training of scientific and pedagogical workers;
- 5) ensuring the availability of the necessary resources for the organization of the educational process, including the independent work of applicants of the third level of higher education, for each educational program;
- 6) ensuring the availability of information systems for effective management of the educational process;
- 7) ensuring publicity of information about educational programs, degrees of education and qualifications;
- 8) provision of an effective system of prevention and detection of academic plagiarism in the scientific works of employees of higher educational institutions and PhD candidates.