

**MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE**

**LVIV POLYTECHNIC NATIONAL UNIVERSITY**

«APPROVED»

Rector

Lviv Polytechnic National University

\_\_\_\_\_ Y.Y. Bobalo

« \_\_\_\_\_ » \_\_\_\_\_ 2021

**SCIENTIFIC-EDUCATIONAL PROGRAM**

**of third level of higher education**

**in specialty 226 «Pharmacy, Industrial Pharmacy»**

**the field of knowledge 22 «Healthcare»**

**Qualification: Doctor of Philosophy in the field 22 «Healthcare»**

**in specialty 226 «Pharmacy, Industrial Pharmacy»**

/Scientific-educational program is certified by the National Agency for Higher Education Quality Assurance (NAQA) (Certificate of educational program accreditation No 1081, date of issue 29.01.2021, valid until 01.07.2026.

Considered and approved  
at the meeting of the Academic  
Council  
(protocol number \_\_\_\_  
from « \_\_\_\_ » \_\_\_\_\_ 2021)

Implemented by order of the Rector from  
«« \_\_\_\_ » \_\_\_\_\_ 2021, number \_\_\_\_

Lviv 2021

Program is established by quality assurance group of scientific-educational program), according to which preparation of third level (scientific-educational) of higher education graduates of specialty 226 «Pharmacy, Industrial Pharmacy» is provided.

**Supervisor:**

Krychkovska Aelita Myronivna – PhD in Pharmacy, Associate Professor, Associate Professor of Department of Technology of Biologically Active Substances, Pharmacy and Biotechnology (TBASPhB)

**Members:**

Lubenets Vira Ilkivna – DSc in Chemistry, Professor, Head of TBASPhB Department;

Marintsova Nataliia – PhD in Chemistry, Associate Professor, Associate Professor of TBASPhB Department;

Hennadiivna – PhD in Chemistry, Associate Professor, Associate Professor of TBASPhB Department;

Hubytska Iryna Ivanivna – PhD in Chemistry, Associate Professor, Associate Professor of TBASPhB Department;

Zhurakhivska Lesia Romanivna – PhD in Chemistry, Associate Professor, Associate Professor of TBASPhB Department;

Bolibrukh Liliia Dmytrivna – PhD in Chemistry, Associate Professor, Associate Professor of TBASPhB Department;

Zaiarniuk Nataliia Leonidivna – PhD in Pharmacy, Associate Professor, Associate Professor of TBASPhB Department;

Stadnytska Nataliia Yevgenivna – PhD in Chemistry, Associate Professor, Associate Professor of TBASPhB Department;

Konechna Roksolana Tarasivna – PhD in Pharmacy, Associate Professor, Associate Professor of TBASPhB Department;

Khomyak Semen – PhD in Chemistry, с.н.с., Associate Professor of TBASPhB Department;

Volodymyrovych – DSc Tech., Prof., директор IXXT;

Skorokhoda Volodymyr – DSc Tech., Prof., директор IXXT;

Yosypovych – DSc Tech., Prof., директор IXXT;

Lyakh Victoria Ruslanivna – postgraduate student of 2<sup>nd</sup> year of education of specialty 226 “Pharmacy, Industrial Pharmacy”;

Bryda Oleksandr – postgraduate student of 3<sup>rd</sup> year of education of specialty 226 “Pharmacy, Industrial Pharmacy”;

Rostislavovych – postgraduate student of 3<sup>rd</sup> year of education of specialty 226 “Pharmacy, Industrial Pharmacy”;

Dyacon Iryna Valeriivna – postgraduate student of 4<sup>th</sup> year of education of specialty 226 “Pharmacy, Industrial Pharmacy”;

Cherpak Oleksandr – general director of Technolab LLC;

Mefodiyovych – general director of Technolab LLC;

Shalata Volodymyr – head of the transfer laboratories of Research&Development center of JSC "Halychpharm" of the "Arterium" corporation;

Yaroslavovych – head of the transfer laboratories of Research&Development center of JSC "Halychpharm" of the "Arterium" corporation;

Izmerli Eridan Yakovych – head of the collegium and professional bureau of students of ICCT;

Kirichuk Anastasiya Oleksiivna – deputy chairman Boards and professional bureau of students of ICCT.

**Guarantor:** \_\_\_\_\_ Doctor of Pharm.Sc., Assoc. Krychkovska A.M.

Approved and put into effect by the Order of the Rector of the National University "Lviv Polytechnic" dated "\_\_\_" \_\_\_\_\_ 2021 No. \_\_\_\_\_.

This educational and scientific program may not be fully or partially reproduced, duplicated and distributed without the permission of Lviv Polytechnic National University.

**LETTER OF AGREEMENT**  
of scientific-educational program

Level of higher education	Third (scientific-educational)
Field of knowledge	22 <i>Healthcare</i>
Specialty	226 <i>Pharmacy, Industrial Pharmacy</i>
Qualification	Doctor of Philosophy

**APPROVED**

Scientific and methodical commission of the specialty  
*226 Pharmacy, Industrial Pharmacy*  
from «\_\_» \_\_\_\_\_ 2021 p.

Head of Scientific and Methodical Council of the specialty  
*226 Pharmacy, Industrial Pharmacy*

\_\_\_\_\_  
«\_\_» \_\_\_\_\_ 2021 p.

Director of Institute of Chemistry and Chemical Technologies  
\_\_\_\_\_  
V.Y. Skorokhoda  
«\_\_» \_\_\_\_\_ 2021 p.

**RECOMMENDED BY**

Scientific and Methodical Council of University  
Protocol No \_\_\_\_\_  
from «\_\_» \_\_\_\_\_ 2021 p.  
Head of Scientific and Methodical Council  
\_\_\_\_\_  
A.H. Zagorodniy

**AGREED**

Head of Educational and Methodical Department  
\_\_\_\_\_  
Sviridov V.M.  
«\_\_» \_\_\_\_\_ 2021 p.

Vice-rector for Scientific Work  
\_\_\_\_\_  
Demydov I.V.  
«\_\_» \_\_\_\_\_ 2021 p.

Vice-Rector for Graduate Education  
\_\_\_\_\_  
Davydchak O.R.  
«\_\_» \_\_\_\_\_ 2021 p.

# I. EDUCATIONAL COMPONENT of SCIENTIFIC-EDUCATIONAL PROGRAM

## 1. Doctor of Philosophy Program Profile in the field of knowledge 22 Healthcare of specialty 226 Pharmacy, Industrial Pharmacy

<b>1 – General Information</b>	
<b>Fullname of higher education institution and structural subdivision of higher education institution</b>	Lviv Polytechnic National University
<b>Fullname of qualification on original language</b>	<b>Doctor of Philosophy in Healthcare by Speciality of Pharmacy, Industrial pharmacy</b>
<b>The official name of the educational program</b>	Pharmacy, Industrial Pharmacy
<b>Type of diploma and volume of the program</b>	Diploma of doctor of philosophy, single, 60 of ECTS credits, duration of educational component of scientific-educational program – 2 years
<b>Cycle / Level</b>	National Qualifications Framework of Ukraine – 8 <sup>th</sup> level; FQ-EHEA – third cycle; EQF-LLL – 9 <sup>th</sup> level
<b>Preconditions</b>	Master level of higher education
<b>Teaching Language(s)</b>	Ukrainian language
<b>Glossary Definition and Meaning</b>	Scientific-educational program contains terms and concepts in accordance with the Law of Ukraine “On Higher Education” from 01.07.2014 No, 2014, No. 1556-VII with further amendments, Law of Ukraine “On science and scientific and technical activity” from 26.11.2015 No 848-VIII with further amendments, Procedure for preparation of applicants for the degree of Doctor of Philosophy and Doctor of Science in higher educational institutions (scientific institutions), approved by Order of the Ministry of Education and Science of Ukraine from 23.03.2016 No216
<b>2 – Aim of Educational Program</b>	
	The program provides great opportunities for deepening book knowledge and practical competences and skills in the field «Healthcare », specialty «Pharmacy, Industrial Pharmacy», to develop philosophical and linguistic competences, to provide theoretical knowledge and practical abilities and skills for solving complex problems in the field of technology, organic synthesis and physicochemical methods of analysis, conducting scientific, research and innovation activities, as well as implementation of the obtained results.
<b>3 - Characteristics of Educational Program</b>	
<b>field of knowledge, specialty) / Subject area (field of knowledge, specialty)</b>	Field of knowledge 22 «Healthcare» , specialty 226 «Pharmacy, Industrial Pharmacy»
<b>Orientation of the educational program</b>	The scientific-educational program is aimed at the development of the theoretical-methodological and methodological-applied base of chemistry with emphasis on the latest trends in the development of the chemistry of potential medicinal products and relevant aspects of the specialty, within which a further scientific and teaching career is possible.
<b>Specifics and differences</b>	The scientific-educational program covers a wide range of modern innovative vectors of the development of the theory and practice of pharmaceutical chemistry, which forms an updated theoretical and

	applied base for conducting scientific research
<b>4 – Eligibility of graduates of the educational program to employment and further education</b>	
<b>Suitability for employment</b>	Workplaces in scientific research institutes of the National Academy of Sciences of Ukraine, institutions of higher education of the Ministry of Education and Science of Ukraine, scientific centers, hi-tech companies and pharmaceutical business
<b>Further education</b>	Completion of the scientific program of the fourth (scientific) level of higher education to obtain the degree of Doctor of Science. Advanced training in research institutes of the National Academy of Sciences of Ukraine, leading universities and research centers of pharmaceutical, chemical and medical-biological profile.
<b>5 – Teaching and assessment</b>	
<b>Teaching and learning</b>	Lectures, practical classes, experimental research in laboratories, elaboration of publications in leading pharmaceutical, chemical and medical-biological publications, consultations with teachers, writing essays, preparation of a dissertation.
<b>Assessment</b>	Exams, assessments, routine monitoring
<b>6 – Software competencies</b>	
<b>Integral competence (INT)</b>	The ability to solve complex problems in the field of pharmacy, fine organic synthesis, pharmaceutical biochemistry, to carry out research and innovation activities that involve a deep rethinking of existing and creation of new integral knowledge, as well as practical implementation of the obtained results.
<b>General competences (GC)</b>	<ol style="list-style-type: none"> <li>1) 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 scientometric databases, automatic generation of links to literary sources, etc.).</li> <li>2) 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 from the relevant specialty, use of modern information technologies (presentation of scientific results).</li> <li>3) Acquisition of universal skills of a researcher, in particular, the organization and conduct of training sessions, the use of modern information technologies (work with VNS, Microsoft Teams, Zoom, etc.).</li> <li>4) Acquisition of universal researcher skills, 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.</li> <li>5) The ability to demonstrate knowledge and understanding of the philosophical methodology of scientific knowledge, psychological and pedagogical aspects of professional and scientific activity, one's own scientific outlook and moral and cultural values.</li> <li>6) The ability to conduct scientific research and implement scientific projects based on the identification of current scientific problems, definition of goals and objectives, formation and critical analysis of the information base, justification and commercialization of research results, formulation of author's conclusions and proposals.</li> </ol>

	<p>7) the ability to effectively communicate with the wider scientific community and the public on topical issues of creating new highly effective, safe medicinal products;</p> <p>8) The ability for continuous professional development based on critical self-evaluation for the purpose of self-improvement and ensuring the quality of education.</p>
<p><b>Special (professional) competences (PC)</b></p>	<p>1) Knowledge and mastery of methods of subtle organic synthesis. Ability applies formed integral insight into subtle organic synthesis in search new one's medical substances. The ability to form clear ideas about the strategy and tactics of modern fine organic synthesis, theoretical foundations of organic chemistry and mechanisms of organic reactions.</p> <p>2) Ability to apply physico-chemical research methods for identification of organic compounds in laboratory conditions. The ability to identify the correspondence between the structure of a substance, its physical and chemical properties, reactivity and methods of its synthesis. The ability to apply knowledge of specific methods of physical and chemical research to identify organic compounds of substances of various classes, including potential medicinal substances</p> <p>3) The ability to carry out qualitative and quantitative analysis of raw materials, semi-products and finished products of chemical and pharmaceutical industries according to the given methodology.</p> <p>4) Use a biochemical approach to study the nature of reactions of the interaction between a medicinal substance and biomolecules . The formation of a holistic view of the process of creating medicines, starting from the moment of conception of the idea of synthesizing a substance of a certain structure, carrying out screening and improving the structure, to the stage of clinical trials and the organization of production based on basic biochemical processes./</p> <p>5) Understand the need for state registration of medicinal products (drugs) that are allowed for circulation in the state and know the procedure for maintaining the state register and the procedure for checking the production of drugs that are submitted for state registration.</p> <p>6) Ability to use a complex of knowledge regarding the principles of pharmaceutical development of drugs of various release forms, conducting laboratory research, clinical trials, registration of drugs, requirements for production, distribution and retail sale and rational use of drugs.</p> <p>7) Ability to demonstrate knowledge of various forms of drug quality control, namely, pharmacopoeial analysis, step-by- step control in the production process, analysis of individually manufactured dosage forms, express analysis in a pharmacy and biopharmaceutical analysis.</p> <p>8) The ability to model the mechanisms of interaction of drugs with biological systems (human organism or experimental animal) at different levels of interaction (subcellular, tissue, systemic) and study the pharmacological effects arising from this.</p> <p>9) The ability to explain the main mechanisms of action of drugs and the main pharmacological effects based on changes in the physiological functions of cells, organs and systems of the human body and to select the correct dose of the drug and its dosage form according to the patient's condition.</p>

	<p>10) The ability to form clear ideas about the methods and techniques of researching the external and internal environment of the enterprise, methods and algorithms for collecting and analyzing information about the pharmaceutical market and the marketing environment of the enterprise, reporting on the results of research, using the results of marketing research in order to ensure a high competitive position of the enterprise.</p> <p>11) The ability to use a complex of knowledge about the properties, functional purpose and methods of research of polymers and UMS for the pharmaceutical development of medicinal products of various forms of release.</p>
<b>7 - Program learning outcomes</b>	
<b>Knowledge (K)</b>	<p>1) The ability to conduct scientific research and implement scientific projects based on the identification of current global scientific problems, definition of goals and objectives, formation and critical analysis of an international information base, substantiation and commercialization of research results, formulation of author's conclusions and proposals. Ability to independently conduct scientific research and make decisions</p> <p>2) The ability to demonstrate knowledge and understanding of the philosophical methodology of scientific knowledge, psychological and pedagogical aspects of professional and scientific activity, one's own scientific outlook and moral and cultural values.</p> <p>3) Summarize modern ideas and concepts of the structure of organic compounds, the main types of mechanisms of chemical reactions. Interpret communication electronic and spatial structures organic compounds from their reactivity ability and physical and chemical properties/</p> <p>4) Outline the fundamental principles of creation targeted materials based _ organic substances _ The ability to conduct scientific research and implement scientific projects based on the identification of current scientific problems, definition of goals and objectives, formation and critical analysis of the information base, substantiation and commercialization of research results, formulation of author's conclusions and proposals;</p> <p>5) Identify the main approaches to planning work on the synthesis and isolation of organic substances, the main methods of constructing organic molecules, the basics of retrosynthetic analysis; explain the concept of ensuring the quality of medicinal products;</p> <p>6) About writing approaches to pharmaceutical developments new ones medical means ; to name requirements for conducting pre-clinical and clinical of research medical means ; use a set of knowledge about methods and techniques of fine organic synthesis for planning the synthesis of model ones compounds;</p> <p>7) Plan and carry out the functionalization of organic compounds and use special methods in preparative organic chemistry (obtaining and transforming functional groups; special methods of synthesis: methods of introducing protective groups, electrochemical methods of transforming organic compounds, sonochemical reactions, chemo- and regio- stereoselective reactions, crown ethers in organic synthesis, synthesis of analogs of natural compounds, biologically active substances); apply knowledge of modern physico-chemical methods of research of organic compounds to identify synthesized substances ; comply with the requirements of labor protection, safety techniques and environmental protection when performing experiments;</p>

	<p>understand the meaning of the concepts "pharmaceutical technologies" and "medical technologies";</p> <p>8) Understand the meaning of the concept of "quality" in medicine and pharmacy; describe the concept of ensuring the quality of medicinal products; name the main quality indicators of medical and pharmaceutical technologies; specify the factors affecting the quality of medicines; describe the principles of rational use of medicines; understand the principles of ensuring the quality of medical technologies; formulate the principles of quality assessment of medical technologies</p> <p>9) To analyze the cause-and-effect relationship of the occurrence of an adverse reaction, to have methods of evaluating the effectiveness and safety of the use of drugs, conducting drug monitoring, researching pharmacogenetics and the interaction of drugs. The ability to create an algorithm for registering an adverse reaction/lack of effectiveness on drugs</p> <p>10) Know the latest chemical, physical and physicochemical methods of pharmaceutical analysis; to be able to conduct pharmacopoeial analysis and to create quality control methods for new drugs; know the methods of detecting specific impurities.</p> <p>11) Know theoretical concepts, categories, systems, tools, algorithms of marketing research processes; basic methods and techniques of conducting marketing research on the market of medicines, medical products and related products of the pharmacy assortment, as well as technologies for conducting research on the behavior of individual consumers and consumer organizations, competitors, suppliers, intermediaries and other subjects of the pharmaceutical market.</p>
<p><b>Skills (S)</b></p>	<p>1) Identify the basic principles of physical and physico-chemical methods of determining the structure of molecules and their complex use; analyze the main trends in the modern development of physical and physicochemical methods for determining the structure of substances and their use in chemical materials science; classify modern instrumental methods of analysis and determine the areas of their use; use different methods to solve analytical tasks: qualitative and quantitative analysis, checking the purity of the substance, identification of the substance, defectoscopy; argue the possibility of combining different methods; correctly choose research methods, use the most effective, reliable and informative methods for a specific compound; interpret the data of spectral methods, know the limits of their application, and conversely, having an organic substance, predict the physicochemical characteristics.</p> <p>2) Describe the schematic diagram and the procedure for setting up the main devices, prepare the devices for work, check their indicators; conduct an analysis of the substance under investigation; make a comparative description of the methods that can be used for the analysis of the test substance; choose a reagent; select the conditions for the analysis; competently evaluate the results of the analysis; have good skills in working with reference literature</p> <p>3) The ability to demonstrate in-depth knowledge of pharmacognostic methods of analysis, which are based on analytically normative documentation (State Pharmacopoeia of Ukraine, State Standards of Ukraine, Technical Conditions of Ukraine, Industry Standards of Ukraine); the basics of the legislative framework of Ukraine, which regulates legal relations related to the creation, registration,</p>



production, quality control and sale of medicinal products, including medicinal plant raw materials and products of their processing.

4) The ability to conduct scientific research and carry out scientific projects with the practical use of theoretical knowledge related to the identification of medicinal plant raw materials, determination of their good quality and conducting commodity, phytochemical and biological studies with the aim of developing projects of quality control methods (QC) or Temporary Pharmacopoeia Article ( TFS). The ability to independently search for new sources of biologically active substances among non-official medicinal plant materials, to isolate and identify extracts and individual substances and to establish the types of their biological activity

5) Ability to carry out preclinical study of medicinal products and examination of materials of preclinical study of medicinal products. The ability to demonstrate knowledge of the rules for conducting clinical trials of medicinal products. Ability to create a registration dossier for state registration (re-registration) of medicinal products. Understanding the procedure for importing unregistered medicinal products, standard samples, and reagents into the territory of Ukraine. The ability to conduct an inspection of the production of medicinal products submitted for state registration.

6) Demonstrate in-depth knowledge of the process of creating medicines, starting from the moment of the idea of synthesizing a substance of a certain structure, conducting screening and improving the structure, close to the stage of clinical trials and the organization of production; demonstrate in-depth knowledge of targets, pharmacokinetics and metabolism of medicinal substances in the body, as well as methods of quantitative assessment of the "structure-activity" relationship; demonstrate in-depth knowledge of experimental methods necessary for understanding biochemical processes.

7) Be able to conduct preclinical study of medicinal products and examination of materials of preclinical study of medicinal products; demonstrate knowledge of the rules for conducting clinical trials of medicinal products; create a registration dossier for state registration (re-registration) of medicinal products; explain the procedure for importing unregistered medicinal products, standard samples, and reagents into the territory of Ukraine; describe the inspection of the production of medicinal products submitted for state registration.

8) Be able to explain the concept of ensuring the quality of medicinal products; describe approaches to the pharmaceutical development of new medicines; name the requirements for conducting clinical and clinical trials of medicinal products; interpret provisions of good manufacturing practice; to state the rules of proper practice of storage and distribution of medicinal products; justify the principles of pharmaceutical development of medicinal products; justify the principles of achieving proper production practices in the production of medicinal products; justify the role of factors affecting the quality of medicinal products; to navigate in regulatory documents regulating the registration of medicinal products and licensing in Ukraine;

9) Apply the main quality indicators of medical and pharmaceutical technologies; outline the factors affecting the quality of medicines; describe the principles of rational use of medicines; explain the principles of ensuring the quality of medical technologies; formulate

the principles of quality assessment of medical technologies; to navigate in the main regulatory documents related to the quality of medical and pharmaceutical technologies; interpret the results of the quality assessment of medical and pharmaceutical technologies; justify approaches and choose tactics to improve the quality of medical and pharmaceutical technologies; implement in practice algorithms for improving the quality of medical and pharmaceutical technologies.

10) Determine the principles of finding new medicines and scientific approaches to their creation; describe the system of examination of new medicinal products; indicate sources of information about medicinal products; describe the principles of introduction to the world pharmaceutical market and the use of new medicines; to formulate the tasks of scientific research in the field of creation of new medicines; develop a scheme of a pharmacological experiment taking into account ethical, deontological aspects, the main indicators of information security; search and carry out analytical work with information on the creation and use of medicinal products;

11) Know the basics of deontology, ethics of communication with doctors, other medical personnel, pharmacist, patient and his family members; describe the main clinical symptoms and syndromes of the most common diseases; name the list of diseases and pathological conditions in which responsible self-treatment is possible, and their characteristic clinical manifestations; describe the clinical and pharmacological characteristics of drugs of various pharmacotherapeutic groups, including combined drugs; specify the pharmacokinetic and pharmacodynamic features of medicinal products, the factors that determine them; explain the principles of the interaction of medicines in the patient's body; describe the methods and criteria for evaluating the clinical effectiveness of drugs of various pharmacotherapeutic groups;

12) Use the necessary regulatory documentation, reference literature and other information sources to ensure rational pharmacotherapy; evaluate the bioequivalence of medicinal products and use the obtained results to ensure rational pharmacotherapy; to prevent the occurrence of side effects/reactions of medicines and to determine the method of their elimination; to participate in the agreement with the doctor of the plan of individualized pharmacotherapy, to carry out its monitoring, especially in the case of responsible self-medication; predict and prevent the occurrence of possible drug-dependent problems in the process of pharmacotherapy.

13) The ability to analyze and predict the development of side effects of drugs and make appropriate corrections, to apply strategies of innovative developments in pharmacology and pharmacy to eliminate unwanted side effects of drugs.

14) The ability to demonstrate knowledge of a set of methods that allow assessing the quality parameters of biologically active substances at all stages of the life cycle of drugs - from development to production to sale

15) Ability to conduct marketing research of the pharmaceutical market in order to resolve specific situations; to form the skills of creative search for reserves for improving the marketing activity of a pharmaceutical enterprise based on the results of conducted research; to investigate the mechanisms of conducting an analysis of the competitiveness and image of the enterprise and its product

<b>Communication (Com)</b>	1) the ability to communicate effectively at the professional and social levels; 2) the ability to present and discuss the obtained results and transfer the acquired knowledge;
<b>Autonomy and Responsibility (A&amp;R)</b>	1) the ability to adapt to new conditions, make decisions independently and initiate original research and innovation complex projects ; 2) the ability to realize the need for lifelong learning in order to deepen acquired and acquire new professional knowledge; 3) the ability to take responsibility for the work performed and to - achieve –the set goal in compliance with the requirements of professional ethics.
<b>8 –Resource support for program implementation</b>	
<b>Specific characteristics of personnel support</b>	100% of the teaching staff involved in teaching professionally oriented disciplines have scientific degrees in their specialty
<b>Specific characteristics of material and technical support</b>	Spectrophotometer " Spekord " M-40 Spectrophotometer " Spekord " M-80 PIK Technic Pro / Vacuum drying chamber DZF 6050 with a VLAB pump Dry-air thermostat TS-80 Ionometer КФО – 2 Magnetic stirrer IKA PIK Technic Pro; PIK AMD Athlon X2 / PC Technic Pro ; PC AMD Athlon X2 Sterilizer GP-10 Aquadistiller MICROmed DE-5 (10 L/h) Rotary evaporator RE -52, cs.vlab pH meter pH - 150MI Electronic scale WPS. 0,3. Multimedia projector (portable) EPSON EMP-TW20 Laminar box Microbiological sterile box
<b>Specific characteristics of informational and methodical support</b>	The use of the virtual learning environment of the National University "Lviv Polytechnic" and author's developments of the teaching staff.
<b>9 – The main components of the educational program</b>	
<b>List of educational components (disciplines, practices, coursework and qualification papers)</b>	The matrix of correspondence of program competencies to educational disciplines and the structure of the educational program are given in the Appendix
<b>10 – Academic mobility</b> (regulated by Order of Cabinet of Ministers of Ukraine No 579 “On Approval of Procedure for Realizing the Right to Academic Mobility" dated August 12, 2015)	
<b>National credit mobility</b>	On the basis of bilateral agreements between the National University "Lviv Polytechnic" and technical universities of Ukraine.
<b>International credit mobility</b>	As part of the EU Erasmus+ program on the basis of bilateral agreements between Lviv Polytechnic National University and educational institutions of partner countries
<b>Education of foreign students of higher education</b>	Possible.

**2. Distribution of the Content of the  
Educational Component of the Educational and Scientific Program by  
Component Groups and Training Cycles**

No s/p	Training cycles	The amount of study load of a graduate student (credits / %)		
		Mandatory components of the educational component	Selective components of the educational component	In total for the entire term teaching
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 postgraduate 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 of s/d	Components of the educational component	Quantity of credits	form of final testing
1	2	3	4
<b>Mandatory components of the educational component</b>			
<i>Cycle of disciplines that form general scientific competences and universal skills of the researcher</i>			
MC1.1.	Philosophy and methodology of science	3	exam
MC1.2.	A foreign language for academic purposes, part 1	4	test
MC1.3.	A foreign language for academic purposes, part 2	4	exam
MC1.4.	Professional pedagogy	3	test
MC1.5.	Academic entrepreneurship	4	test
MC1.6.	Pedagogical practice	3	test
Total per cycle:		<b>21</b>	
<b><i>Cycle of disciplines forming professional competences</i></b>			
MC2.1.	Methods of fine organic synthesis	4	exam
MC2.2.	Modern methods of identification of organic compounds	3	test
MC2.3.	Methods of pharmacognostic analysis and quality control of medicinal plant raw materials	3	test
Total per cycle:		<b>10</b>	
<b>Selective components of the educational component **</b>			
<i>Cycle of disciplines that form general scientific competences and universal skills of the researcher</i>			
SC1.1	Business Foreign Language	3	test
SC1.2	Psychology of creativity and invention	3	test
SC1.3	Management of scientific projects	3	test
SC1.4	Technology of registration of grant applications and patent rights	3	test
SC1.5	Rhetoric	3	test
SC1.6	Modern inventions in research activities	3	test
SC1.7	Open scientific practices	3	test
SC1.8	Academic integrity and quality of education	3	test
SC1.9	Methodology of preparation of scientific publications	3	test
SC1.10	Quality of higher education (formation of internal quality assurance systems)	3	test
Total per cycle:		<b>3</b>	
<b><i>Cycle of disciplines forming professional competences</i></b>			
SC2.1	Good practices in pharmacy (good manufacturing practice, good clinical practice, good laboratory practice, good pharmacy practice, good distribution practice)	3	exam
SC2.2	Assessment of the quality of medical and pharmaceutical technologies (quality of drugs, quality of treatment)	3	exam
SC2.3	Clinical and pharmaceutical foundations of drug creation (principles of finding new drugs, research of new drugs, introduction of drugs into medical practice)	3	exam
SC2.4	Use of medicines in clinical practice (in-depth study of pharmacotherapy)	3	exam
SC2.5	High molecular compounds as components of pharmaceutical systems with controlled release of the active substance	3	exam
SC2.6	Pharmaceutical biochemistry	3	exam
SC2.7	Regulatory support for registration of new medicinal products	3	exam
SC2.8	Biopharmaceutical aspects of side effects of drugs	3	exam

SC2.9	Marketing tools of pharmaceutical market analysis	3	exam
SC2.10	Methods of pharmaceutical analysis	3	exam
	Total:	<b>6 (3+3)</b>	
<b>Disciplines of the postgraduate student's free choice **</b>			
SC3.1	Discipline of the graduate student's free choice**	3	
BTotal per cycle:		<b>3</b>	
<b>TOTALLY</b>		<b>43</b>	

#### 4. MATRIX OF CORRESPONDENCE OF SOFTWARE COMPETENCES TO THE COMPONENTS OF THE EDUCATIONAL PROGRAM

	MC1.1.	MC1.2.	MC1.3.	MC1.4.	MC1.5.	MC1.6.	MC2.1.	MC2.2.	MC2.3.	SC1.1.	SC1.2.	SC1.3.	SC1.4.	SC1.5.	SC1.6.	SC1.7.	SC1.8.	SC1.9.	SC1.10.	SC2.1.	SC2.2.	SC2.3.	SC2.4.	SC2.5.	SC2.6.	SC2.7.	SC2.8.	SC2.9.	SC2.10.
INT	•	•	•	•	•	•	•	•	•	•	•	•	•	•						•	•	•	•	•					
GC1	•																												
GC2		•	•							•																			
GC3				•		•																							
GC4					•								•																
GC5											•																		
GC6												•																	
GC7														•															
GC7														•															
SC1							•																						
SC2								•																					
SC3									•																				
SC4																									•				
SC5																										•			
SC6																				•		•							
SC7																					•								
SC8																							•						•
SC9																											•		
SC10																													•
SC11																								•					

/

**Symbolic notation:** MC<sub>i</sub> – compulsory discipline, SC<sub>i</sub> – selective discipline, i – discipline number in the list of components of the educational component, INT – integral competence, ZK<sub>j</sub> – general competence, GC<sub>j</sub> – professional (special) competence, j – competence number in the list of competencies of the educational component

## 5. MATRIX OF PROVIDING SOFTWARE LEARNING OUTCOMES BY RELEVANT COMPONENTS EDUCATIONAL PROGRAMS

	MC1.1.	MC1.2.	MC1.3.	MC1.4.	MC1.5.	MC1.6.	MC1.7.	MC2.1.	MC2.2.	MC2.3.	MC2.4.	MC2.5.	SC1.1.	SC1.2.	SC1.3.	SC1.4.	SC1.5.	SC2.1.	SC2.2.	SC2.3.	SC2.4.	SC2.5.	
K1		•	•			•		•	•	•			•		•	•							
K2	•			•			•																•
K3					•			•													•		
K4						•		•						•			•						•
K5								•															
K6										•								•	•	•	•		
K7								•	•	•	•							•	•	•	•		
K8												•						•	•	•	•	•	
S1								•	•														•
S2									•							•							•
S3											•	•						•	•				•
S4									•		•	•							•				
S5												•						•		•			
S6										•													
S7												•					•	•					
S8												•				•		•	•				
S9																	•		•				
S10		•	•			•							•		•			•				•	
S11																			•	•	•	•	
S12										•		•	•							•	•	•	
COM1	•	•	•				•			•	•							•	•				
COM2				•		•										•	•						•
A&R1								•	•	•	•	•			•			•	•	•	•	•	•
A&R2	•	•	•		•	•		•	•	•	•	•						•	•	•	•	•	•
A&R3								•	•	•	•	•						•	•	•	•	•	•

**Symbolic notation:** MC<sub>i</sub> – compulsory discipline, SC<sub>i</sub> – selective discipline, i – discipline number in the list of components of the educational component, S<sub>m</sub> – program results (knowledge), S<sub>m</sub> – program results (skills), m – program result number in the list program results of the educational component.



## **II. The scientific component of the educational and scientific program**

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.

Dissertation for obtaining the degree of Doctor of Philosophy is an independent detailed study that offers a solution to an actual scientific and applied task in the specialty 226 "Pharmacy, Industrial pharmacy", the results of which are characterized by scientific novelty and practical value and are published in relevant publications.

The scientific component of the educational-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.

Preparation and publication of scientific articles, speeches at scientific conferences, scientific professional 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 226 " Pharmacy, Industrial Pharmacy":**

1. Sulfur functionalized carbo- and heterocyclic systems with antiplatelet and antioxidant activities as new promising substances for the treatment of arterial thrombosis.
2. Development of the theoretical basis for the creation of promising thiosulfonate means of protection of agricultural products from microorganisms - producers of mycotoxins.
3. Development of a disinfectant agent against tuberculosis pathogens of a wide range of applications.
4. Creation of new medicines, phyto- and biological preparations.
5. Biotechnological and phytochemical aspects of the study of the process of obtaining biologically active compounds from medicinal plants.
6. Research of pharmaceutical market segments: production, quality control, distribution, public supply.
7. Development and improvement of technologies for obtaining plant extracts and phytopreparations.

### **III. Certification 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.

Candidates of higher education for the degree of Doctor of Philosophy defend their dissertations, as a rule, in a permanent specialized academic council for the relevant specialty, which functions 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 .

**Structural and logical scheme of the educational and scientific program of the doctor of philosophy in the specialty  
226 «Pharmacy, Industrial Pharmacy»**

