Ministry of Education and Science of Ukraine

Lesya Ukrainka Eastern European National University

EDUCATIONAL SCIENTIFIC PROGRAM (ONP)

"Synthesis and study of properties of inorganic and organic substances"

third (educational scientific) level of higher education

specialty 102 – Chemistry

field of knowledge 10 – Natural sciences

Qualification: Philosophy Doctor

APPROVED BY THE SCIENTIFIC COUNCIL

Chairman of the Academic Council

_____ / prof. Tsos A. B. /

(Protocol №8 of " 23 " June 2020

ONP enacted on " 23 " June 2020

Rector _____ / prof. Tsos A. B. /

(Protocol №159-z of " 23 " June 2020

Lutsk – 2020

LETTER OF APPROVAL

of Educational Scientific program

Level of higher education	**Third (educational scientific) level**
Field of knowledge	**10 – Natural sciences**
Specialty	**102 – Chemistry**
Specialization (ONP)	**---**
Qualification	**Philosophy Doctor**

DEVELOPED AND APPROVED
Scientific Methodological Commission, Department of Chemistry, Ecology and Pharmacy
Protocol № _____
of "_____" _____ 2020
Chairman of the SMC
_____ O.S. Muzychenko

AGREED
Vice-Rector for Academic Affairs and Recruitment of Lesya Ukrainka Eastern European National University

_____ Y. V. Gromyk
"____" _____ 2020

PREFACE

Developed and introduced by the support group of the Department of Chemistry, Ecology and Pharmacy of Lesya Ukrainka Eastern European National University.

Olekseyuk I.D. – Doctor of chemical sciences, Professor, guarantor of educational scientific program;

Gulay L. D. – Doctor of Chemical Sciences, Professor;

Marchuk O.V. – Ph.D. (Chemistry), Associate Professor;

Slyvka N.Y. – Ph.D. (Chemistry), Associate Professor.

Educational Scientific program was discussed and approved at the meeting of the Scientific Council of the Department of Chemistry, Ecology and Pharmacy (Protocol № _12_ of "_19_" June 2020).

Chairman of the Academic Council of the Department of Chemistry, Ecology and Pharmacy

_____ L.P. Marushko

Approved and enacted

By order of the Rector of the Lesya Ukrainka Eastern European National University

of «____» _____ 2020 No. _____.

I . Profile of the educational and scientific program in the specialty

102 Chemistry

1. General information	
Full name of the higher education institution and structural unit	Lesya Ukrainka Eastern European National University, Department of Chemistry, Ecology and Pharmacy
Level of higher education	Third (educational scientific) level of higher education, NLC Ukraine – Level 8
Degree of higher education	Doctor of Philosophy
Field of knowledge	10 – Natural sciences
Specialty	102 – Chemistry
Educational qualification	Doctor of Philosophy
Professional qualification	----
Official title of the educational scientific programs	Synthesis and study of the properties of inorganic and organic substances
Qualification in diploma	Doctor of Philosophy
Study load	60 ECTS credits
Availability of accreditation	Introductory
Prerequisites	Level of higher education "Specialist", "Master"
Language of instruction	Ukrainian
The term of educational scientific program	4 years
Internet address of the permanent placement of the educational scientific program	https://vnu.edu.ua/uk/faculties-and-institutions/fakultet-khimii-ekologii-ta-farmacii

2. Purpose of the educational scientific program	
	To feepen theoretical knowledge and practical abilities and skills in chemistry, to develop philosophical and linguistic competence, to form the universal research skills sufficient to perform and successfully complete research on obtaining new materials and to further professional and research activities in the field of chemistry, capable of solving major problems in chemistry; to perform targeted research; to introduce innovations in the industry; to conduct pedagogical activities in educational institutions of different levels at a high scientific and methodological level; to perform scientific research at the international level in academic institutions of Ukraine and abroad.
3. Characteristics of the educational scientific program	
Subject area (field of knowledge, specialty)	Field of knowledge: 10 – Natural sciences, specialty: 102 – Chemistry
Orientation of educational scientific program	Educational Scientific program (ONP) is based on the fundamental postulates of modern chemistry and the results of scientific research in the area of synthesis and investigation of new substances, materials with predetermined properties. ONP is oriented to the development of methodological and applied basis of chemistry with emphasis on solving energy security, scientific and technological support of the defense industry of the country, which provides current scientific research and a high level of professional and scientific training of the applicants of the third (educational scientific) level.
Features of the program	A particularity of ONP is the emphasis on practical training of applicants which involves search for new inorganic materials for various fields of semiconductor device design, determination of the crystal structure of found phases, the development of single crystal growth technology of

	chalcogenide and halide phases and the study of their properties following by recommendations for practical use; synthesis of heterocyclic compounds, investigation of isolation methods and structure determination of physiologically active substances from natural raw materials and natural materials analysis by gas chromatography, development of new optical and electrochemical sensors for determination of biologically active and toxic substances.
4. Suitability of graduates of educational scientific program to employment and further training	
Suitability for employment	Jobs in public and private higher education institutions, scientific and research institutions in the positions of instructors and researchers, in enterprises and organizations of various activities and forms of ownership in management positions.
Further training	Application of the scientific program of the fourth (scientific) level of higher education for obtaining the degree of the Doctor of Sciences.
5. Teaching and evaluation	
Teaching and learning	Combination of lectures, laboratory and practical classes, pedagogical workshop, consultation with the supervisor, scientific and pedagogical community with independent scientific and educational work.
Evaluation	Discussions, debates, tests, solving problems/cases, individual tasks/individual work of students, working in small groups, modular reference work/quizzes, essays, analytical essays, tests, examinations . There are four grades in the national scale (Excellent, Good, Satisfactory, Unsatisfactory) and 100-point ECTS scale: 90–100 Excellent, 82–89 Very Good, 75–81 Good, 67–74 Satisfactory, 60–66 Sufficient, 1–59 Unsatisfactory.
6. Program competencies (Table 1)	
Integral competence (INT)	Ability to solve complex problems in the fields of the professional and/or research-innovation activities that

	requires deep rethinking of current and development of new integral knowledge and/or professional practices.
General Competences (ZK)	**ZK1.** Ability to use academic Ukrainian and foreign languages in professional activities and research. Ability to use a foreign language orally and in writing to understand foreign scientific and professional texts, to communicate in foreign scientific and professional environments. **ZK 2.** Ability for critical analysis, evaluation of existing knowledge, synthesis of new and complex ideas based on logical arguments and verified facts. **ZK 3.** Ability to apply knowledge in practical situations. Gaining flexibility of thinking open to the application of acquired chemical knowledge to solve strategic and current problems of industrial development, as well as to the application of acquired knowledge in practical situations. **ZK 4.** The ability to conduct independent scientific research. Acquisition of competencies for initiating and performing research which provides an opportunity to rethink existing and gain new knowledge. **ZK 5.** Creativity. Ability to generate new ideas, abstract thinking, achieving scientific goals, finding the best solutions in new conditions and situations. **ZK 6.** Ability to work in a team. Ability to perform scientific research in a group, understanding the responsibility for the results, requirements of discipline, planning and time management. Ability to develop and manage research projects. **ZK 7.** Communication skills. Ability to communicate with different target audiences, present complex information in a convenient and understandable way, present the results of their own research orally and in writing, using appropriate vocabulary, methods, information-communication technologies and technical means.

	ZK 8. Ethical attitudes. Adherence to ethical principles in scientific research, honesty and integrity in their professional activities and daily lives. **ZK 9.** Ability to search, process and analyze information from various sources. **ZK 10.** Teaching and promotion skills. Ability to communicate with non-specialists, some skills of organization and conducting training sessions. **ZK 11.** Management skills. Ability to work in conditions of limited time and resources, motivate and manage the work of others to achieve goals.
Special competencies	**SC1.** Deep knowledge in the specialty. Knowledge and understanding of the advanced level in the field of chemistry and related fields, including methods of experiments, the level of knowledge should be sufficient for research at recent international levels and is aimed at broadening and deepening them. **SC2.** Research abilities. The ability to articulate at the present level the scientific problem, the working hypothesis of the investigated problem, to perform original research in the field of chemistry, to achieve research results that create new integral knowledge, to solve problems and tasks by understanding their fundamental basics and use both theoretical and experimental methods mastered from the educational scientific program. **SC3.** Technological capabilities. The ability to select and use scientific equipment, advanced information communication technologies and procedures that relate to chemical and physico-chemical research methods. **SC4.** Ability to critically analyze and evaluate data. Ability to analyze data of performed experiments, including the use of computer technology, to interpret the results of experiments,

	and to take part in discussions concerning the scientific and practical significance of the results. **SC5.** Skills of presentation of results of own scientific research and leading discussions both orally and in written form. **SC6.** The ability to plan, develop and perform scientific projects, create proposals on funding research. **SK7.** Ability to self-development and self-improvement. Ability to master new branches of science through independent learning, using the acquired professional knowledge, skills and abilities. **SC8.** Skills on application of information technologies and corresponding software for scientific research and interpretation of results.
7. Expected study results (Table 2)	
Knowledge (PRZN)	1. In-depth knowledge of thermodynamics of chemical processes and phase transformations. 2. In-depth knowledge of the laws that link the structure of the compound with its properties and reactivity. 3. Knowledge of theoretical and applied problems of applied chemistry and methods of inorganic and organic synthesis. 4. In-depth knowledge of modern methods of determining the composition and the structure of chemical compounds, control the flow of chemical processes. 5. Knowledge and understanding of philosophical methodology of scientific knowledge, psychological and pedagogical aspects of professional and scientific activity, own scientific worldview and moral and cultural values.
Skills (PRUN)	1. Critical analysis, evaluation, and synthesis of new and complex ideas. Application of acquired knowledge in various subject areas of chemistry to formulate and justify new theoretical positions and practical recommendations in a particular area of research.

	2. Starting, planning, realization and correction of a sequence of the process of thorough scientific study of compliance with proper academic integrity. 3. Apply knowledge of patterns of the relationship of the structure of compounds and substances with physical and chemical properties for solving theoretical and applied problems. 4. Apply knowledge of chemical thermodynamics to real processes, predict thermodynamic properties and reactivity of substances. 5. Ability to use proper Ukrainian and foreign languages in professional activities and research, to present the results of scientific research in oral and written form, to organize and teach classes.
Communication (PRCOM)	1. Ability to use modern information communication tools and technologies to ensure effective scientific and professional communications.
Autonomy and responsibility (PRAiV)	1. The ability to independently perform scientific research and make decisions. 2. Ability to formulate own conclusions, suggestions and recommendations. 3. Ability to realize and take personal responsibility for the results of the study. 4. Ability for continuous self-development and self-improvement.
8. Resource support for the implementation of the educational program	
Specific staffing characteristics	100% of research and teaching staff involved in teaching a series of disciplines that provide special (professional) competencies of the graduate student have degrees and academic titles.
Specific characteristics of material and technical	Use of material and technical support of laboratories of the Department of Chemistry, Ecology and Pharmacy

support	(https://vnu.edu.ua/uk/faculties-and-institutions/fakultet-khimii-ekologii-ta-farmacii)
Specific characteristics of informational and methodical support	Use of a virtual learning environment on educational platforms Moodle, Google Classroom, Office 365 and internal developments of scientific and pedagogical stuff of the Eastern European National University.
9 . Academic mobility	
National credit mobility	Based on agreements between Eastern European National University (Department of Inorganic and Physical Chemistry) and Uzhgorod National University (Department of Inorganic Chemistry), Order of MES of Ukraine on the use of the center for collective use of scientific equipment "Laboratory of Materials intermetallic compounds" at the National University of Lviv and other contracts (https://vnu.edu.ua/uk/faculties-and-institutions/fakultet-khimii-ekologii-ta-farmacii)
International credit mobility	Within the framework of the EU program Erasmus+ and on the basis of bilateral agreements between Lesya Ukrainka Eastern European National University and the University of Saarland (Germany) (https://vnu.edu.ua/uk/faculties-and-institutions/fakultet-khimii-ekologii-ta-farmacii)
Training of foreign graduate students	Provided they know Ukrainian language. The University provides opportunity to learn Ukrainian or to improve the skills at the preparatory department of Education and Research Institute of Continuing Education (https://vnu.edu.ua/uk/pidgotovche-viddilennya).

List of components of the educational part of the educational scientific program

Code n/a		Credit load	Form of control
CYCLE 1. MANDATORY SUBJECTS			
1.1. GENERAL MANDATORY SUBJECTS (ONDZP 1 .1. 0)			
ONDZP 1.1.1	Foreign Language	**8**	Test; examination
ONDZP 1.1.2	Academic integrity and scientific ethics	**3**	Test
ONDZP 1.1.3	Philosophy and methodology of science	**6**	Test; examination
ONDZP 1.1.4	Pedagogical basis of professional communicative competence	**3**	Test
1.2. PROFESSIONAL MANDATORY SUBJECTS (ONDPP 1 .2. 0)			
ONDPP 1.2.1	Latest aspects of the development of modern chemistry	**7**	Test; examination
ONDPP 1.2.2	Solid state chemistry	**6**	Test; examination
ONDPP 1.2.3	Current trends in the development of organic synthesis	**6**	Test; examination
ONDPP 1.2.4	Pedagogical practice	**6**	Test
Total per cycle		**45**	
CYCLE 2. ELECTIVE SUBJECTS			
2.1. GENERAL ELECTIVE SUBJECTS (VNDZP 2.1. 0)			
VNDZP 2.1.1	Scientific product promotion and project management	**3**	Test
VNDZP 2.1.2	Interactive learning technologies		
VNDZP 2.1.3	Methodology and organization of scientific research		
VNDZP 2.1.4	Business modeling of scientific research		
VNDZP 2.1.5	Data analysis	**3**	Test
VNDZP 2.1.6	Mathematical methods, models and information technologies in scientific research		
VNDZP 2.1.7	Information search and work with library resources	**3**	Test
VNDZP 2.1.8	Academic rhetoric		

2.2. PROFESSIONAL ELECTIVE SUBJECTS (VNDPP 2.2. 0)			
VNDPP 2.2.1	A subject from the master's program	**3**	test
VNDPP 2.2.2	Crystal chemistry of chalcogenides	**3**	test
VNDPP 2.2.3	Methods of separation and concentration of substances		
VNDPP 2.2.4	Chemistry of medicines		
VNDPP 2.2.5	Thermodynamics of phase equilibria		
VNDPP 2.2.6	Chemical sensors		
Total per cycle		**15**	
Overall Total		**60**	

II. SCIENCE COMPONENT OF THE EDUCATIONAL SCIENTIFIC PROGRAM

Research work of graduate students is a mandatory component of the training of highly qualified specialists (philosophy doctors), able to independently perform scientific research, creatively solve specific professional or scientific problems. It is not accounted in the credit load. The scientific component includes performing fundamental and/or applied scientific research in higher education and/or scientific institution, preparing to the public defense of the dissertation research topics of which were defined the relevant scientific unit and approved of by the Scientific Council of the university, writing and publishing articles and approbation of the results of the dissertation research, in accordance with the current requirements approved by the Ministry of Education and Science of Ukraine.

The Scientific Advisor directs and monitors execution of the graduate student’s research work which conditionally can be divided into preparatory and primary stages and includes the following activities.

At the preparatory stage, the graduate student:

1. Selects the topic of research and justifies the relevance of the chosen research topic. Reviews catalogs of defended theses and familiarizes oneself with theses work earlier performed at the Department. Reviews the latest research results in chemistry and related fields of science. Familiarizes oneself with analytical reviews and articles in professional journals, consults with experts to identify little-studied research issues and problems of interest. Studies and analyzes the main approaches and positions of scientific schools and trends in solving the problem under study;

clarifies the terminology in the chosen field of knowledge. Searches for literature sources on the selected topic.

2. Plans the dissertation work by drawing up the Individual Plan of the Graduate Student, work plan of the graduate student.

3. Sets out the objective and tasks of dissertation work. Defines the object and subject of the scientific research.

4. Selects methods (techniques) of research.

During the main stage of research, the graduate student:

1. Performs research work according to the ONP profile of the graduate school, with the use of knowledge and skills obtained in the course of the study of fundamental and applied subjects of the education component of the program. Is engaged in scientific work aimed at the implementation of the theoretical and practical part of the study.

2. Analyzes and summarizes the results of scientific research based on modern inter-disciplinary approaches, application of scientific methodological principles and research methods, use of topical information resources, of leading domestic and foreign expertise in research.

3. Prepares and submits publications on the thesis topic: monographs and scientific publications in national professional journals, a list which is approved by the central body of executive power in the sphere of education and science, and journals included in international science metric databases, other publications.

4. Provides approbation of results of scientific research by participation in scientific conferences: international and foreign, Ukrainian, regional and inter-university, and also in scientific seminars. Participates in competitions of scientific works.

5. Participates in the activities of the Council of Young Scientists at the University.

6. Is involved in the implementation of state budget or other topics within the framework of state and academic grants, as well as work plans of scientific departments of the university.

7. If the invention was obtained according to the scientific results of research, the graduate student prepares and submits documents for obtaining a patent for an invention (copyright certificate).

8. Is engaged in research and preparation of dissertation work, formulation of conclusions of the thesis.

9. Passes preliminary examination of the dissertation at a professional seminar.

10. Engaged in the preparation of the thesis manuscript.

11. Defends the thesis at a specialized academic council.

Research work is reflected in the Individual Plan of the Graduate Student. Control over the implementation of the Individual Plan is achieved by attestation. Attestation of graduate students is carried out according to the educational plan of philosophy doctors according to specialty. Intermediate certification is held twice a year at meetings of the departments of Chemistry and Technologies or Organic Chemistry and Pharmacy, taking into account the place of work of the Scientific Advisor. Annual attestation of graduate students is held once a year at a meeting of the Scientific Council of the Department of Chemistry, Ecology and Pharmacy.

Attestation of graduate students reviews the performance of the requirements of both educational and the scientific component of the educational scientific program. Graduate students who have successfully passed the annual certification are promoted to the next year of study. Graduate students who have not passed the certification are subject to expulsion.

III. PEDAGOGICAL PRACTICE

Pedagogical practice is a mandatory component of the ONP for training philosophy doctors in specialty 102 Chemistry at the Department of Chemistry, Ecology and Pharmacy in Lesya Ukrainka Eastern European National University. It aims to provide the graduate student with the professional skills and abilities of an instructor at a higher education institution.

Training practical abilities and skills of a graduate to prepare educational and methodological support, preparation and teaching classes, within subjects taught by the Scientific Advisor, takes place during the pedagogical practice scheduled in the educational plan for the second year of study.

The purpose of the pedagogical practice is to deepen and consolidate the knowledge of graduate students on the organization and forms of implementation of the educational process in modern terms, its scientific, educational and methodological and regulatory support, forming skills of the study of research and information sources when preparing lessons, use of active teaching methods of the subjects of the professional training cycle for the specialty 102 Chemistry.

Passing pedagogical practice involves the postgraduate student performing the following types of work: preparation of and leading seminars; preparation of educational and methodical support for leading seminars; preparation of educational and methodological support for tests and exams in the disciplines read.

IV. QUALIFICATION CERTIFICATION OF THE POSTGRADUATE STUDENT

Certification of postgraduate carried out according to the educational plan of preparation PhD on specialty Chemistry. In the process of training philosophy doctors, two forms of attestation are

used: intermediate and final in accordance with the current legal documents of the Ministry of Education and Science of Ukraine and Lesya Ukrainka Eastern European National University.

Intermediate certification

The purpose of the intermediate attestation is to control the implementation of the individual plan of the graduate student for all components provided by the curriculum. Intermediate certification includes three modules: 1) theoretical, 2) research, 3) practical.

Certification according to the theoretical module involves passing exams in accordance with the curriculum for the preparation of philosophy doctors in the specialty 102 Chemistry.

The research module, according to the initial plan, provides for the current certification of graduate students once a year. The purpose of interim certification is control over the implementation of individual plan of the scientific research and compliance with the schedule of preparation of scientific and research work.

The practical module, according to the initial plan, provides for pedagogical practice in the second year of study. The purpose of the intermediate attestation for the practical component is to control the implementation of the individual plan and the acquisition by the graduate student of professional skills and abilities of an instructor at a higher education institution.

Final certification

The purpose of the final certification is the establishment of compliance of educational and scientific training of graduate requirements PNP of Doctor of Philosophy in specialty Chemistry. The form of the final certification is the public defense of scientific research work presented in a thesis. It allows testing the satisfactory level of scientific and research preparation of the graduate to the requirements that are put forward to the Doctor of Philosophy in specialty Chemistry.

Final certification in the form of a public defense of the thesis provides a specialized scientific council, according to the requirements of s Ministries and Education and Science of Ukraine under the current regulatory and legal documents. The dissertation work of Doctor of Philosophy in specialty Chemistry fulfills basic research and professional qualification function which is expressed in the ability of the Ph.D. applicant to conduct independent scientific research, solve applied scientific tasks, and implement their scientific generalization as a personal contribution to the development of modern chemistry and practices. It is the result of independent research work of the graduate student and has the status of an intellectual product of the rights of the manuscript.

Table 1. Matrix of correspondence of program competences to components of the educational scientific program

	ONDP Z 1.1.1	ONDP Z 1.1.2	ONDP Z 1.1.3	ONDP Z 1.1.4	ONDP P 1.2.1	ONDP P 1.2.2	ONDP P 1.2.3	ONDP P 1.2.4
INT			+		+	+	+	
ZK1	+							
ZK2		+			+	+	+	+
ZK3					+	+	+	+
ZK4			+			+	+	
ZK5		+	+			+	+	
ZK6				+			+	
ZK7				+				+
ZK8			+	+				
ZK9					+	+	+	+
ZK10				+			+	+
ZK11							+	
SC1			+		+	+	+	+
SC2			+		+	+	+	
SC3			+			+	+	
SC4			+			+	+	+
SC5								+
SC6							+	
SC7			+		+	+	+	+
SC8							+	

Table 2. Matrix of correspondence of expected study results (PRN) to the relevant components of the educational-professional / educational-scientific / educational-creative program

	ONDP Z1.1.1	ONDP Z1.1.2	ONDP Z 1.1.3	ONDP Z 1.1.4	ONDP P 1.2.1	ONDP P 1.2.2	ONDP P 1.2.3	ONDP P 1.2.4
PRUN1					+	+		
PRUN2					+	+		
PRUN3					+	+	+	
PRUN4						+	+	
PRUN5	+				+	+	+	+
PRZN1					+	+		
PRZN2					+	+		
PRZN3					+	+	+	
PRZN4					+	+	+	
PRZN5		+	+	+				+
PRCOM1					+	+	+	+
PRAiV1						+	+	
PRAiV2				+		+	+	+
PRAiV3		+	+					
PRAiV4		+	+					