

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
LVIV POLYTECHNIC NATIONAL UNIVERSITY

"APPROVED"

Rector
of Lviv Polytechnic
National University

_____ prof. Yurii Bobalo
" ____ " _____ 2023 y.

EDUCATIONAL AND SCIENTIFIC PROGRAM
third (educational and scientific) level of higher education

Field of
knowledge

12 Information Technology

Specialty

125 Cybersecurity and Information Protection

Qualification

Doctor of Philosophy in Information Technology

in the specialty "Cybersecurity and Information Protection"

Considered and approved at the meeting
of the Lviv Polytechnic National University
Academic Council
(protocol № ____ of " ____ " _____ 2023 y)

Developed by a working group to ensure the quality of educational and scientific program, which trains applicants at the third (educational and scientific) level of higher education in the specialty 125 Cybersecurity, consisting of:

1. L. Parkhuts – DScTech., Prof., professor of Information Security Department;
2. V. Dudykevych – DScTech., Prof., head of Information Security Department;
3. V. Maksymovych – DScTech., Prof., head of Information Technology Security Department;
4. V. Khoma – DScTech., Prof., professor of Information Security Department;
5. V. Melnyk – DScTech., Prof., professor of Information Technology Security Department;
6. I. Opirskyi – DScTech., Assoc. prof., professor of Information Security Department;
7. S. Voytusyc – CSc(Phys&Math.), Assoc. prof., Assoc. prof. of Information Technology Security Department;
8. O. Garasymchuk – CScTech., Assoc. prof., Assoc. prof. of Information Security Department;
9. Ya. Sovyn – CScTech., Assoc. prof., Assoc. prof. of Information Security Department;
10. R. Kyten – postgraduate student of 1 year of study in specialty 125 "Cybersecurity";
11. Yu. Storonskyi – CScTech., director of Ltd "Spring-Vist Centre", c. Lviv
12. N. Tymoshyc – CScTech., technical director of Ltd "Defend Ukraine", c. Lviv
13. T. Chura – chairman of the board and trade union bureau of ICTA

Working group leader (guarantor): _____ DScTech., Prof. **L. Parhuts**

Considered at a meeting of the Scientific and Methodological Commission 125
Cybersecurity

Protocol № __ of " __ " ____ 2023 y.

Chairman of the Scientific and Methodological Commission of the specialty 125
Cybersecurity

_____ DScTech., Prof. **V. Dudykevych**

Considered at a meeting of the Scientific and Methodological Council of the University

Protocol № ____ of " __ " _____ 2023 y.

Chairman of the Scientific and Methodological Council of the University

_____ CScEcon., Prof. **A. Zagorodnyi**

Approved and entered into force by Order of the rector of Lviv Polytechnic
National University № _____ of " __ " _____ 2023 y.

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I. EDUCATIONAL COMPONENT OF THE EDUCATIONAL AND SCIENTIFIC PROGRAM

1. PROGRAM PROFILE OF THE DOCTOR OF PHILOSOPHY

FROM SPECIALTY 125 CYBERSECURITY AND INFORMATION PROTECTION

1	2
1 – general information	
Full name of the higher education institution and structural unit	Lviv Polytechnic National University
Full title of the qualification in the original language	Доктор філософії в галузі "Інформаційні технології" спеціальність "Кібербезпека та захист інформації" // Philosophy Doctor degree in "Information Technology" specialty "Cybersecurity and information protection"
The official title of the educational program	Кібербезпека Cybersecurity
Type of diploma and scope of educational program	Doctor of Philosophy diploma, unitary, 48 ECTS credits, term of the educational component of the educational and scientific program is 1.5 years
Availability of accreditation	
Cycle / level	National qualifications framework of Ukraine – 8 level, FQ-EHEA – third cycle, EQF-LLL – 8 level
Precondition	level of higher education " master "
Language(s) of teaching	English language
Basic concepts and their definitions	The program uses basic concepts and their definitions in accordance with the Law of Ukraine "On Higher Education" and Guidelines for the development of standards of higher education approved by the higher education sector of the Scientific and Methodological Council of the Ministry of Education and Science of Ukraine, protocol № 3 of 29.03.2016.
2 – The purpose of the educational program	
	Provide theoretical knowledge and practical skills and abilities to solve complex problems in the field of information technology, information security, conducting scientific, research and innovation activities, as well as the implementation of the results.
3 - Characteristics of the educational program	
Subject area (field of knowledge, specialty)	Information technology: Cybersecurity
Orientation of the educational program	The educational and scientific program is aimed at actual aspects of the specialty, within which further scientific and teaching career is possible.
The main focus of the educational program and specialization	Acquisition of the necessary research skills for a scientific career, teaching special disciplines in the field of information technology, information security, information protection, as well as commercialization of research results and technology transfer. Keywords: information technologies, information security, cybersecurity, information security management, information protection.
Features and differences	The scientific component of the educational and scientific program is determined by the individual curriculum of the postgraduate student
4 – Suitability of graduates of the educational program to employment and further study	
Suitability for employment	Jobs in research institutes of the National Academy of Sciences of Ukraine, higher educational institutions of the Ministry of Education and Science of Ukraine, research centers and high-tech companies with information security and information protection profile, public and private enterprises related to information, state, economic and military security.
Further study	Advanced qualification in research institutes of the National Academy of Sciences of Ukraine, leading universities and research centers of public and private enterprises related to information security and information protection.
5 – Teaching and evaluation	
Teaching and evaluation	Lectures, practical classes, experimental research in laboratories, processing of publications in leading publications of the information security profile, consultations with teachers, writing abstracts, preparation of dissertation.
Evaluation	Written and verbal exams, tests, verbal presentations.
6 – Program competencies	

1	2
Integral competence	Ability to solve complex problems in the field of information security, to conduct research and innovation activities, which involves a deep rethinking of existing and creation of new integral knowledge, as well as the practical implementation of the results.
General competencies	<ol style="list-style-type: none"> 1) systematic knowledge of modern research methods in the field of information technology and information security and related fields; 2) critical analysis, evaluation and synthesis of new ideas; 3) ability to communicate effectively with the general scientific community and the public on topical issues of information security and information protection; 4) ability to self-develop and self-improvement during life, responsibility for teaching others; 5) social responsibility for the results of strategic decisions; 6) initiation of original research and innovation complex projects; 7) leadership and ability of both autonomous and team work during project implementation.
Special (professional) competencies	<ol style="list-style-type: none"> 1) knowledge of current development trends and the most important new scientific achievements in the field of information technology, information security, information protection, and related; 2) systematic knowledge and understanding of modern scientific theories and methods, and the ability to effectively apply them to the synthesis and analysis of information security systems; 3) ability to effectively apply methods of analysis, mathematical modeling, perform physical and mathematical experiments in scientific research; 4) ability to integrate knowledge from other disciplines, apply a systematic approach and take into account non-technical aspects in solving engineering problems and conducting research; 5) ability to develop and implement projects, including own research, which give the opportunity to rethink existing or create new knowledge; 6) the ability to argue the choice of method of solving a specialized problem, to critically evaluate the results and defend the decisions made.
7 – Program learning results	
Knowledge	<ol style="list-style-type: none"> 1) ability to demonstrate systematic knowledge of modern research methods in the field of information technology, information security and information protection; 2) the ability to demonstrate in-depth knowledge in the chosen field of scientific research; 3) ability to demonstrate understanding of the impact of technical solutions in the social, economic and social context; 4) search, analyze and critically evaluate information from various sources; 5) apply knowledge and understanding to solve problems of synthesis and analysis of elements and systems characteristic of the chosen field of research; 6) systematically think and apply creative abilities to the formation of fundamentally new ideas in the field of information security.
Skills	<ol style="list-style-type: none"> 1) 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 research; 2) to combine theory and practice, as well as to make decisions and develop a strategy for solving problems in the field of information security, taking into account universal values, social, state and industrial interests; 3) work effectively both individually and as a team; 4) independently perform experimental research and apply research skills; 5) apply the acquired knowledge and understanding to identify, formulate and solve problems of information security, using known and offering their own methods; 6) argue the choice of methods for solving scientific and applied problems, critically evaluate the results and defend the made decisions.
Communication	<ol style="list-style-type: none"> 1) ability to communicate effectively at professional and social levels; 2) ability to present and discuss the obtained results and to transfer the acquired knowledge;
Autonomy and responsibility	<ol style="list-style-type: none"> 1) ability to adapt to new conditions, make decisions independently and initiate original research and innovation complex projects; 2) the ability to be aware of the need for lifelong learning in order to deepen the acquired and acquire new professional knowledge; 3) ability relay to the work responsibly and achieve the set goal in compliance with the

1	2
	requirements of professional ethics.
8 – Resource support for program implementation	
Specific characteristics of staffing	100% of the teaching staff involved in teaching professionally-oriented disciplines have degrees in the specialty
Specific characteristics of material and technical support	The use of modern equipment of leading companies in the field of information technology and information security, including Xilinx, Altera, as well as standardized domestic hardware and software information security, key certification center, production of the "Institute of Information Technology" (Kharkov), and the use of modern applications programs for effective solution of problems on technical protection of information and automation of its processing.
Specific characteristics of information and methodological support	Use of the virtual learning environment of the Lviv Polytechnic National University and author's developments of the teaching staff.
9 – The main components of the educational program	
List of educational components (disciplines, practices, course and qualification works)	The matrix of correspondence of program competencies to academic disciplines and the structure of the curriculum are given in the Appendix
10 – Academic mobility	
(regulated by the Resolution of the Cabinet of Ministers of Ukraine № 579 "On approval of the Regulations on the procedure for realization the right for academic mobility "of August 12, 2015)	
National credit mobility	Based on bilateral agreements between Lviv Polytechnic National University and technical universities of Ukraine.
International credit mobility	Within the framework of the EU Erasmus + program on the basis of bilateral agreements between Lviv Polytechnic National University and educational institutions of partner countries.
Training of foreign applicants for higher education	Possible.

2. DISTRIBUTION OF THE CONTENT OF THE EDUCATIONAL AND SCIENTIFIC PROGRAM BY GROUPS OF COMPONENTS AND CYCLES OF PREPARATION

Training cycle	Volume of educational loading of the applicant of higher education (credits /%)					
	Common components of the educational and professional program		Selective components of the educational-professional program		Total for the entire period of study	
<i>General training cycle</i>	21	49 %	3	7 %	24	56 %
<i>Cycle of professional training</i>	10	23 %	6	14 %	16	37 %
<i>Cycle of subjects of free choice of a graduate student</i>	–	–	3	7 %	3	7 %
Total for the entire period of study	33	72 %	12	28 %	43	100 %

3. LIST OF COMPONENTS OF THE EDUCATIONAL COMPONENT OF EDUCATIONAL AND SCIENTIFIC PROGRAM

Code	Components of the educational component	Credits	Control
1. Required components of the educational component			
<i>1.1. The cycle of disciplines that form general scientific competencies and universal skills of a researcher</i>			
OK1.1	Philosophy and methodology of science	3	exam
OK1.2	Foreign language for academic purposes, part 1	4	test
OK1.3	Foreign language for academic purposes, part 2	4	exam
OK1.4	Professional pedagogy	3	exam
OK1.5	Academic entrepreneurship	4	test
OK1.6	Pedagogical practicum *	3	test
<i>Total per cycle:</i>		21	
<i>1.2. A cycle of disciplines that form professional competencies</i>			
OK2.1	Analytical and numerical research methods	4	exam
OK2.2	Research seminar in the field of cyber security and information protection	3	test
OK2.3	Research methods in the field of cyber security and information protection	3	test
<i>Total per cycle:</i>		10	
3. Selective components of the educational component			
<i>2.1. Cycle of disciplines that form general scientific competencies and universal skills of the researcher (chooses 1 discipline)</i>			
BB1.1	Business foreign language	3	test
BB1.2	Psychology of creativity and invention	3	test
BB1.3	Management of scientific projects	3	test
BB1.4	Technology of design of grant applications and patent rights	3	test
BB1.5	Rhetoric	3	test
BB1.6	Modern inventions in research activity	3	test
BB1.7	Open scientific practices	3	test
BB1.8	Academic integrity and quality of education	3	test
BB1.9	Methodology of preparation of scientific publications	3	test
BB1.10	Quality of higher education (formation of internal quality assurance systems)	3	test
<i>Total per cycle:</i>		3	
<i>2.2. Cycle of disciplines that form professional competencies (chooses 2 disciplines)</i>			
BB2.1	Security of wireless and mobile networks	3	exam
BB2.2	Security of cloud technologies	3	exam
BB2.3	Generation of random and pseudo-random numbers	3	exam
BB2.4	Protection of information in communication channels	3	exam
BB2.5	Cryptographic engineering	3	exam
BB2.6	Computer processing of information with limited access	3	exam
BB2.7	Mathematical and computer modeling in scientific research	3	exam
BB2.8	Methods of conducting a scientific experiment	3	exam
BB2.9	Optimization of architecture and traffic of secure networks	3	exam
BB2.10	Digital expertise	3	exam
BB2.11	Artificial intellect in information systems	3	exam
BB2.12	WEB security	3	exam
<i>Total per cycle:</i>		6	
<i>2.3. Disciplines of free choice of graduate student</i>			
BB3.1	Discipline of free choice of graduate student **	3	
<i>Total per cycle:</i>		3	
TOTAL		43	

Remark: * – pedagogical practicum can take place in the second or third year of study;

** – the graduate student has the opportunity to choose subjects from item 2, item 3 (elective and free choice), thus the share of these subjects should make not less than 25% of total number of ECTS credits.

4. MATRIX OF COMPLIANCE OF PROGRAM COMPETENCIES TO THE COMPONENTS OF THE EDUCATIONAL PROGRAM

Disci- plines Compe- tencies	OK 1.1	OK 1.2	OK 1.3	OK 1.4	OK 1.5	OK 1.6	OK 2.1	OK 2.2	OK 2.3	BB 1.1	BB 1.2	BB 1.3	BB 1.4	BB 1.5	BB 1.6	BB 1.7	BB 1.8	BB 1.9	BB 1.10	BB 2.1	BB 2.2	BB 2.3	BB 2.4	BB 2.5	BB 2.6	BB 2.7	BB 2.8	BB 2.9	BB 2.10	BB 2.11	BB 2.12
IHT	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
ЗК 1			•				•				•							•					•	•	•						
ЗК 2	•		•		•		•	•				•				•												•		•	
ЗК 3	•			•	•	•		•		•	•		•	•									•						•		
ЗК 4	•			•	•	•				•	•		•				•							•		•					
ЗК 5		•	•				•	•				•			•																
ЗК 6	•			•	•		•	•				•	•												•	•					
ЗК 7	•			•	•	•					•		•	•																	•
ФК 1		•					•	•	•	•	•	•						•		•	•	•	•	•	•	•	•	•	•	•	•
ФК 2		•	•				•	•	•	•										•	•	•	•	•	•	•	•	•	•	•	•
ФК 3		•	•					•	•	•						•				•	•	•	•	•	•	•	•	•	•	•	•
ФК 4		•		•				•	•	•	•			•			•							•	•	•					
ФК 5		•						•	•	•	•								•	•	•	•	•	•	•	•	•	•	•	•	•
ФК 6	•	•	•	•				•	•	•	•				•					•	•	•	•	•	•	•					

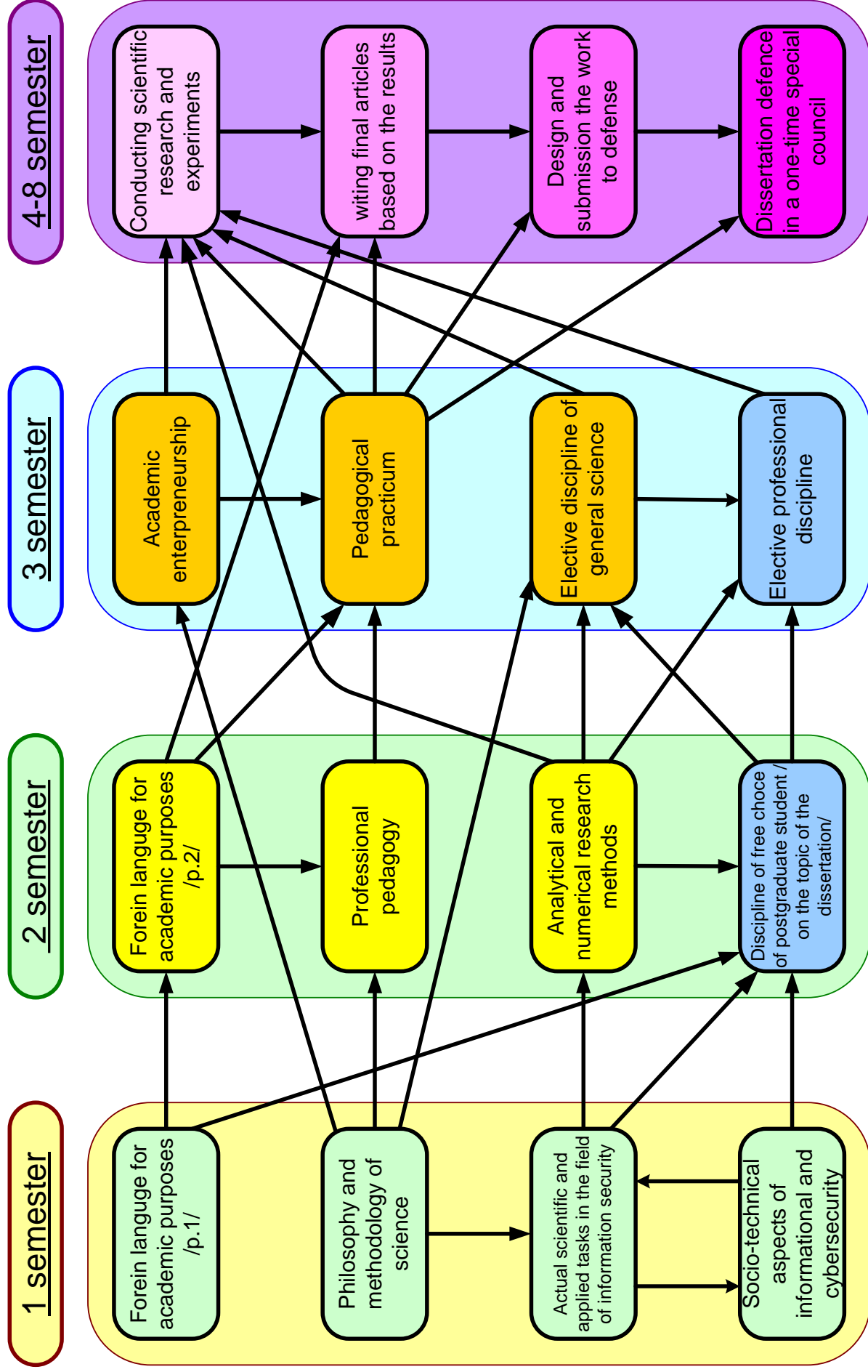
Marking: OK i – required discipline, BB i – selective discipline, i – the number of the discipline in the list of components of the educational component, IHT – integral competence, ЗК j – general competence, ФК j – professional (special) competence, j – competence number in the list of competencies of the educational component.

5. MATRIX OF PROVIDING PROGRAM LEARNING RESULTS BY APPROPRIATE COMPONENTS OF THE EDUCATIONAL PROGRAM

Results teaching \ Disciplines	Required disciplines (OK)										Selective disciplines (BB)																				
	OK 1.1	OK 1.2	OK 1.3	OK 1.4	OK 1.5	OK 1.6	OK 2.1	OK 2.2	OK 2.3	BB 1.1	BB 1.2	BB 1.3	BB 1.4	BB 1.5	BB 1.6	BB 1.7	BB 1.8	BB 1.9	BB 1.10	BB 2.1	BB 2.2	BB 2.3	BB 2.4	BB 2.5	BB 2.6	BB 2.7	BB 2.8	BB 2.9	BB 2.10	BB 2.11	BB 2.12
3H 1		•	•				•	•								•								•	•	•	•	•	•	•	•
3H 2	•	•		•	•		•						•								•	•	•	•	•	•	•	•	•	•	
3H 3	•			•	•		•			•					•			•		•	•	•	•	•	•	•	•	•	•	•	
3H 4	•	•		•	•	•	•	•		•				•						•	•	•	•	•	•	•	•	•	•	•	
3H 5	•			•	•	•				•									•					•	•	•	•	•	•	•	
3H 6		•								•	•	•	•	•																	
YM 1	•	•			•	•	•	•		•		•								•	•	•	•	•	•	•	•	•	•	•	
YM 2	•		•	•	•	•	•	•			•					•					•				•	•	•	•	•	•	
YM 3	•			•	•	•	•	•			•			•										•	•	•	•	•	•	•	
YM 4	•	•	•	•	•	•		•			•		•				•							•	•	•	•	•	•	•	
YM 5	•			•	•		•	•		•	•	•	•							•	•	•	•	•	•	•	•	•	•	•	
YM 6	•	•	•	•		•		•		•	•		•							•	•	•	•	•	•	•	•	•	•	•	
KOM 1	•	•	•	•		•		•		•	•			•		•									•	•	•	•	•	•	
KOM 2	•	•	•	•		•		•		•	•		•						•						•	•	•	•	•	•	
AiB 1	•	•		•	•	•		•			•	•	•											•	•	•					
AiB 2	•			•			•				•	•	•			•															
AiB 3	•	•		•	•		•				•	•	•	•																	

Marking: OK_i – required discipline, BB_i – selective discipline, *i* – the number of the discipline in the list of components of the educational component, 3H_m – program results (knowledge), YM_m – program results (skills), KOM_m – program results (communication), AiB_m – program results (autonomy and responsibility), *m* – the number of the program result in the list of program results of the educational component.

Structural and logical scheme of the educational and scientific program “Cybersecurity and information protection”



II. SCIENTIFIC COMPONENT OF THE EDUCATIONAL AND SCIENTIFIC PROGRAM

The scientific component of the educational and scientific program involves the graduate student's own research under the guidance of one or two supervisors and registration of its results in the form of a dissertation.

The dissertation for the degree of Doctor of Philosophy is an independent detailed research that offers a topical scientific problem in the specialty 125 Cybersecurity, the results of which are an original contribution to the amount of knowledge in the specialty 125 Cybersecurity and published in relevant publications.

The scientific component of the educational and scientific program is made out in the form of the individual plan of scientific work of the postgraduate student and is an integral part of the curriculum of postgraduate study.

An integral part of the scientific component of the educational and scientific program of graduate school is the preparation and publication of scientific articles, presentations at scientific conferences, scientific professional seminars, round tables, symposia.

Research topics in the specialty 125 Cybersecurity

1. Methods and means of building effective information security systems.
2. Methods and means of creating automated systems for processing information with limited access.
3. Methods and means of optimizing the architecture of secure computer networks.
4. Methods and means of traffic optimization of secure computer networks.
5. Methods and means of generating random and pseudo-random numbers and bit sequences.
6. Methods and means of digital image processing.
7. Methods and means of digital expertise.
8. Methods and means of information protection in communication channels.
9. Methods and means of cryptographic security of information.
10. Systems for the use of artificial intellect in information and cybersystems.
11. Methods and means of ensuring the security of wireless and mobile networks.
12. Methods and means of security of cloud technologies.
13. Methods and means of protection of the perimeter of the controlled area of the object.

III. CERTIFICATION OF POSTGRADUATE STUDENTS

Certification of higher education candidates for the degree of Doctor of Philosophy is carried out by a specialized academic council, permanent or formed for one-time defense, on the basis of public defense of scientific achievements in the form of a dissertation.

The amount of the dissertation for the degree of Doctor of Philosophy in the specialty 125 "Cybersecurity" should be set at 4.0-5.5 printed sheets.

Successful completion of his / her individual curriculum by the graduate student is a prerequisite for admission to the defense.

Applicants for the degree of Doctor of Philosophy defend their dissertations, as a rule, in a permanent specialized scientific council in the relevant specialty, which operates in the higher educational institution where the graduate student was trained.

The Academic Council of a higher education institution has the right to submit to the National Agency for Quality Assurance in Higher Education documents for accreditation of a specialized academic council established for one-time defense, or apply to another higher education institution where a permanent specialized academic council in the relevant specialty operates.