

**MINISTRY OF DEFENSE OF UKRAINE**  
**NATIONAL DEFENCE UNIVERSITY OF UKRAINE**

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**EDUCATIONAL AND SCIENTIFIC  
PROGRAM**

“ Information systems and technologies ”

**the third (educational and scientific) degree  
of higher education**

**Specialty** № 126 Information systems and technologies  
**Area of expertise** № 12 Information technologies

APPROVED BY THE SCIENTIFIC COUNCIL OF  
THE NATIONAL DEFENCE UNIVERSITY OF  
UKRAINE  
(Protocol No. 9 dated 21.08.2023)

**Київ 2023**

## PREFACE

The educational and scientific program "Information Systems and Technologies" of the third (educational and scientific) level of higher education for the preparation of Doctors of Philosophy in the field of "Information Technology" in the specialty "Information Systems and Technologies" is developed in accordance with the requirements of the Law of Ukraine "On Higher Education" (as amended), resolutions of the Cabinet of Ministers of Ukraine of 23. 03.2016 № 261 "Procedure for the preparation of applicants for higher education degrees of Doctor of Philosophy and Doctor of Science in higher education institutions (research institutions)" (as amended) and of 23.11.2011 № 1341 "On approval of the National Qualifications Framework" (as amended by the resolutions of the Cabinet of Ministers of Ukraine of 12. 06.2019 No. 509 and 25.06.2020 No. 519); No. 44 of January 12, 2022 "On Approval of the Procedure for Awarding the Degree of Doctor of Philosophy and Cancellation of the Decision of a One-time Specialized Academic Council of a Higher Education Institution, Scientific Institution on Awarding the Degree of Doctor of Philosophy"; Order of the Ministry of Defense of Ukraine of February 15, 2019 No. 65 "On the Distribution of the Main Areas of Scientific Research between Scientific Institutions, Higher Military Educational Institutions, Military Educational Units of Higher Education Institutions of the Ministry of Defense of Ukraine and the Armed Forces of Ukraine".

The educational and scientific program "Information Systems and Technologies" is developed taking into account the recommendations and recognized scientific practices of scientific education of the European Education Area, in particular: Salzburg Principles (Salzburg I Conclusion and Recommendation from the Bologna Seminar on "Doctoral Programs for the European Knowledge Society", 2005 & Salzburg II "Initiative Recommendations of the European University Association", 2010).

Developed by a working group consisting of:

1. Doctor of Technical Sciences, Professor, Serhii Mykusia (Project Team Leader - guarantor of the educational and scientific program).
2. Doctor of Technical Sciences, Associate Professor Oleksandr Zhuk.
3. Candidate of Technical Sciences, Associate Professor Volodymyr Chernega.
4. Doctor of Technical Sciences, Professor, Honored Worker of Science and Technology of Ukraine, Oleksandr PERMiAKOV.
5. Candidate of Military Sciences, Dmytro SHEVCHENKO.
6. Doctor of Pedagogical Sciences, Senior Researcher, Leonid Oliynyk.

Stakeholders involved:

1. Candidate of Military Sciences, Professor, Pavlo Shchypanskyi.
2. Doctor of Philosophy in the field of "Information Technology" with a degree in "Computer Science" Serhii FARAON (graduate of the adjunct program in 2022).
3. Adjunct (full-time) Dmytro Ilyin.

**1. Profile of the educational and scientific program "Information Systems and Technologies" in the specialty 122 "Information Systems and Technologies"**

<b>1 - General information</b>	
<b>Full name of the higher education institution and subdivision</b>	The National Defense University of Ukraine
<b>Higher education degree and qualification</b>	Philosophy Doctor of Information Technology in the Sector of Information system and technology
<b>The official name of the educational program</b>	Information system and technologies
<b>Diploma Type for the educational program scope</b>	Diploma of Doctor of Philosophy in the field of "Information Technology" in the specialty "Information Systems and Technologies", single, volume of educational component 46 ECTS credits Duration of study 4 years
<b>Accreditation availability</b>	
<b>Cycle/degree</b>	NRC of Ukraine – 3 cycle / 8 level, QF-EHEA – Third Cycle / EQF-LLL– Level 8
<b>Preconditions</b>	Second (master's) level of higher education
<b>Language(s) of instruction</b>	Ukrainian and English
<b>The duration of the educational program</b>	4 years
<b>Internet address of permanent program placement</b>	<a href="https://nuou.org.ua/">https://nuou.org.ua/</a>
<b>2- The purpose of the educational program</b>	
training of highly qualified, competitive specialists capable of conducting independent research, scientific and pedagogical, scientific and organizational activities, the results of which are of theoretical and practical importance in the field of information technology for the needs of the components of the Security and Defense Sector of Ukraine, taking into account compatibility with the Armed Forces of NATO member states.	
<b>3 - Characteristics of the program</b>	
<b>Subject area (area of knowledge, specialty, specialization ( if any))</b>	The <i>objects</i> of study are the principles, criteria, models, methods, methodologies and technologies of designing, creating and effective application of information processing systems to solve urgent problems

using information technology for the needs of the components of the Security and Defense Sector of Ukraine, taking into account compatibility with the Armed Forces of NATO member states.

*Learning objectives:* acquiring the ability to produce new ideas, solve complex scientific and applied problems and challenges in the field of professional and research and innovation activities in the field of information technology, which involves a deep rethinking of existing and creation of new holistic knowledge of professional practice for the needs of the security and defense sector of Ukraine, taking into account compatibility with the Armed Forces of NATO member states.

*Theoretical content of the subject area* - concepts and principles (theoretical and methodological foundations and tools for the creation and use of information technology; evaluation criteria and methods for ensuring the quality, reliability, fault tolerance, survivability and security of information technology and systems, optimization principles, models and methods of decision-making under conditions of uncertainty; patterns of information communications, theoretical and applied principles of building and implementing intelligent information technology) as such, that ensure the acquisition of relevant competencies by the graduate for the needs of the security and defense sector of Ukraine, taking into account compatibility with the armed forces of NATO member states

*Methods, techniques and technologies* of scientific cognition: the applicant must master the methods, techniques and technologies of scientific research, teaching, team management in solving problems of designing information systems, creating, researching, optimizing and maintaining such objects by methods, methodologies, techniques and approaches of related fields that use IT for the

	<p>needs of the components of the Security and Defense Sector of Ukraine, taking into account compatibility with the Armed Forces of NATO member states.</p> <p><i>Tools and equipment:</i> the applicant must be able to use computer equipment, control and measuring devices, technical means, software and hardware systems, network technologies, etc.</p>
<p><b>Educational program orientation</b></p>	<p>Educational and scientific (Doctor of Philosophy), academic.</p>
<p><b>The main educational program focus and specialization focus</b></p>	<p>The educational and scientific program "Information Systems and Technologies" is aimed at training highly qualified specialists capable of solving significant problems in the field of information technology for the needs of the security and defense sector of Ukraine, expanding and reassessing existing knowledge and professional practices based on conceptual and methodological knowledge in the field of information technology, taking into account compatibility with the Armed Forces of NATO member states.</p> <p>Keywords: theoretical and methodological foundations and tools for the creation and use of information technologies; evaluation criteria and methods for ensuring the quality, reliability, fault tolerance, survivability and security of information technologies and systems, optimization principles, models and methods of decision-making under uncertainty; regularities of building information communications, theoretical and applied principles of building and implementing intelligent information technologies, components of the security and defense sector of Ukraine, interoperability with the armed forces of NATO member states.</p>
<p><b>Program peculiarities</b></p>	<p>The peculiarity of the program is its multidisciplinary nature, original conceptual approach that takes into account the country's strategic course towards Euro-Atlantic integration and ensures the integrity of training specialists capable of solving</p>

	<p>significant problems in the field of information technology for the needs of the security and defense sector of Ukraine, taking into account compatibility with the armed forces of NATO member states.</p> <p>The peculiarity of the program is its multidisciplinary nature, original conceptual approach that takes into account the country's strategic course towards Euro-Atlantic integration and ensures the integrity of training specialists capable of solving significant problems in the field of information technology for the needs of the security and defense sector of Ukraine, taking into account compatibility with the armed forces of NATO member states.</p>
<b>4 – Graduates applicability for further employment and education</b>	
<b>Graduates applicability</b>	<p>Scientific and scientific-pedagogical positions in higher military educational institutions, military authorities and scientific institutions of the security and defense sector of Ukraine.</p>
<b>Further education</b>	<p>Training for development and self-improvement in scientific and professional fields of activity, as well as other related fields of knowledge:</p> <ul style="list-style-type: none"> <li>- obtaining a doctoral degree;</li> <li>- Educational programs, research grants and scholarships (including those abroad) that contain additional educational components.</li> </ul>
<b>5 - Teaching and evaluation</b>	
<b>Teaching and studying</b>	<p>The academic disciplines of the educational and scientific program encourage active work on dissertation research, develop skills in its organization, execution, publication, testing and implementation of scientific results in Ukrainian and English.</p> <p>In general, a problem-oriented approach to teaching is used.</p> <p>In order to form an individual learning trajectory, the elective components of the educational and scientific program are selected by the applicant before the beginning of the third semester of study in</p>

	<p>agreement with the supervisor and the head of the university structural unit from the elective component of this ESP and the proposed additional list of primary disciplines (appendix to the curriculum), taught at the second (master's) level of higher education at the National Defense University of Ukraine, provided that they are relevant to the subject of the applicant's dissertation research and are not included in the completed curricula for obtaining operational and strategic levels of military education. Teaching is based on the principles of academic integrity, collegiality, responsibility and high academic culture. The main types of classes are lectures, seminars, consultations, and independent work.</p>
<b>Evaluation</b>	<p>Entrance control (entrance examinations). Current control (surveys, individual tasks for the preparation of parts of the dissertation research). Final control (exams, differentiated tests). Public defense of scientific achievements in the form of a dissertation Forms of control: oral and written questioning; test tasks; defense of practice, essays, individual, group and collective projects; tests, differentiated tests; exams; reporting on the implementation of the individual plan of the applicant; defense of the qualification work of the Doctor of Philosophy.</p>
<b>6 - Program competencies</b>	
<b>Integral competence</b>	<p>Ability to generate new ideas, solve complex problems in the field of professional and research and innovation activities, which involves a deep rethinking of existing and creation of new holistic knowledge and professional practice in the field of information technology for the needs of the security and defense sector.</p>
<b>General competencies</b>	<p>GC01. Ability to abstract thinking, analysis and synthesis, to form a systematic scientific outlook, professional ethics and general cultural</p>

	<p>outlook.</p> <p>GC02. Ability to apply theoretical knowledge in practical situations in scientific activities.</p> <p>GC03. Ability to initiate research and innovation projects and work autonomously during their implementation.</p> <p>GC04. Ability to communicate with colleagues, the wider academic community and the public in Ukrainian and one of the foreign languages of the European space.</p> <p>GC05. Understanding of the importance of compliance with ethical standards and copyright in conducting research, presenting its results and in scientific and pedagogical activities, as well as the ability to protect copyrights and prepare patents</p> <p>GC06. Ability to identify, formulate and solve problems, generate ideas and make informed decisions.</p>
<p><b>Special (professional, subject-orientated) competencies</b></p>	<p>SC01. Ability to develop scientific and methodological foundations for the creation and application of information technologies and systems for automated information processing and management.</p> <p>SC02. Possession of skills in the development and research of models and methods for assessing the quality and improving the reliability, functional safety and survivability of information systems and digital services.</p> <p>GC03. Knowledge of methods of planning and conducting experiments (including active, passive, simulation), statistical processing of their results.</p> <p>SC04. Ability to organize the development of creative initiative, rationalization, invention, implementation of achievements of domestic and foreign science, technology, use of best practices that ensure the effective operation of a unit, enterprise, educational institution, research or design institution.</p> <p>SC05. Availability of a system of special knowledge on the organization of the pedagogical process in higher education institutions and the use of pedagogical technologies in higher education; basic</p>



knowledge in the field of modern information technologies; basic knowledge of pedagogy and psychology of higher education, necessary for teaching a set of special disciplines in the process of training specialists in information systems and technologies.

SC06. Ability to develop fundamental models of information technology, design and create prototypes of information systems and digital services.

SC07. Ability to organize and support the implementation of a set of information security measures, manage the process of their implementation, taking into account the tasks to be solved and the organizational structure of the object of protection, external influences, threats and the level of development of information security technologies.

SC08. Ability to analyze data and evaluate the necessary knowledge to solve non-standard problems using mathematical methods and computer modeling methods.

SC09. Ability to manage information resources, information systems and digital services.

SC10. Ability to reasonably choose and use methods and tools of scientific research, conduct modeling in the field of information systems and technologies for the needs of the security and defense sector of the state, taking into account compatibility with the Armed Forces of NATO member states.

SC11. Have in-depth knowledge of information technology and systems, including understanding of theoretical and practical problems, history of development and current state of scientific knowledge, critical analysis of basic concepts, mastery of scientific terminology in the interests of the security and defense sector of the state, taking into account compatibility with the Armed Forces of NATO member states.

SC12. Ability to justify requirements for improving military management processes through the introduction of information (information and communication) technologies

	<p>and systems.</p> <p>SC13. Ability to apply information (information and communication) technologies to improve combat (economic) efficiency of complex military systems.</p> <p>SC14. Ability to create information models of military management processes at all levels using information (information and communication) technologies.</p> <p>SC15. Ability to apply knowledge in the field of information systems and technologies to solve military management problems.</p>
<b>7 – Learning outcomes</b>	
	<p>LO01. Analyze fundamental and modern works of leading foreign and domestic scientists in the chosen field of study, formulate the purpose and objectives of their own scientific research as part of the general civilization process.</p> <p>LO02. Possession of general scientific philosophical knowledge necessary for the formulation of a scientific worldview, professional ethics and cultural outlook.</p> <p>LO03. Present and discuss scientific results in the state and foreign languages in oral and written form.</p> <p>LO04. Perform original scientific research on information systems and digital services at the appropriate professional level, achieve scientific results that create new knowledge to solve current problems.</p> <p>LO05. Manage research projects and prepare proposals for research funding.</p> <p>LO06. To cooperate with specialists from various fields in the framework of scientific projects on the development and research of information systems and technologies, using the principles of professional ethics and skills of professional ethical behavior.</p> <p>LO07. Apply scientific and pedagogical technologies, formulate content, learning objectives, ways to achieve them, forms of control, and be responsible for the effectiveness of the educational process.</p> <p>LO08. Design complete Industry 4.0 systems (including endpoints, network connections,</p>

cloud platforms, data exchange and analysis, etc.).

LO09. Optimize software in accordance with the principles of service-oriented architecture of distributed software systems.

LO10. Manage the creation and use of information systems and digital services.

LO11. Apply computer information security methods in the design of information systems and digital services in various subject areas.

LO12. Apply methods of consolidation, transformation, visualization, quality assessment, and data pre-processing to prepare data for analysis.

LO13. Conduct intelligent analysis of electronic data sets to solve specific practical problems.

LO14. Be able to use foreign and domestic universal software tools and analytical platforms to search for patterns, relationships, rules, knowledge in electronic data sets.

LO15. Apply modern software and hardware tools to solve applied problems of building information systems and digital services.

LO16. To reengineer applied information systems, business processes and digital services.

LO17. Design and optimize information systems to support IT infrastructure using modern tools.

LO18. Possess specialized abilities, skills and methods necessary to solve significant problems in the field of professional activity, science, innovation, critical rethinking and expansion of existing knowledge in the field of information systems and technologies for the needs of the security and defense sector, taking into account compatibility with the Armed Forces of NATO member states.

LO19. To critically analyze, evaluate and synthesize new and complex ideas in the field of information systems and technologies for the needs of the security and defense sector.

LO20. To develop mathematical models, methods, techniques, computer modeling and

	conduct practical experiments to verify their adequacy, evaluate the effectiveness of the scientific results obtained, develop proposals for their further implementation in the systems of automated control of troops and weapons of the security and defense sector, taking into account compatibility with the Armed Forces of NATO member states.
<b>8 – Program implementation resources</b>	
<b>Staffing/personnel</b>	The program involves scientific and pedagogical and scientific staff with a high level of professional and academic qualifications are involved in the program implementation.
<b>Logistics</b>	PhD students are provided with free access to all resources of the educational environment of the National Defense University of Ukraine, including classroom facilities, educational libraries, computer and specialized classrooms, conference rooms, the Internet and the Moodle intranet; for leisure activities: sports grounds, stadiums, swimming pool, comfortable dormitories.
<b>Information, education and methodology support</b>	<p>The library of the National Defence University of Ukraine is provided with scientific professional periodicals of the appropriate profile, including in electronic form. There is access to databases of periodicals in English.</p> <p>There is an official website of the National Defence University of Ukraine (<a href="https://nuou.org.ua">https://nuou.org.ua</a>), which contains basic information about the educational and scientific programs, curriculum, syllabuses of educational components, educational, educational and scientific, publishing activities of the National Defense University of Ukraine and its structure, educational and scientific structural units and their composition, admission rules, contact information, etc.</p> <p>Available: Internet access; wireless Internet access points; Moodle learning environment. The National Defence University of Ukraine has: curriculum and working curriculum;</p>

	<p>educational process schedules; work programs of academic disciplines; educational and methodological support for each academic discipline of the curriculum; didactic materials for independent and individual work of applicants in disciplines; textbooks, textbooks, lecture notes, etc. in accordance with the list of recommended literature in each academic discipline, the number of which meets the established requirements.</p> <p>Access of applicants to information and educational and methodological support is free of charge.</p>
<b>9 – Academic mobility</b>	
<b>National credit mobility</b>	It is carried out in accordance with agreements and memorandums on scientific and scientific-technical cooperation with institutions of the National Sciences Academy of Ukraine, universities and scientific organizations
<b>International credit mobility</b>	It is carried out in accordance with the requirements established by the legislation of Ukraine for the preservation of state secrets within the limits. In accordance with cooperation agreements with foreign military universities, joint educational and scientific projects (ERASMUS +, DEEP UKRAINE Programme), involvement in international conferences
<b>Training of foreign applicants for higher education</b>	According to special agreements within the framework of educational and research projects

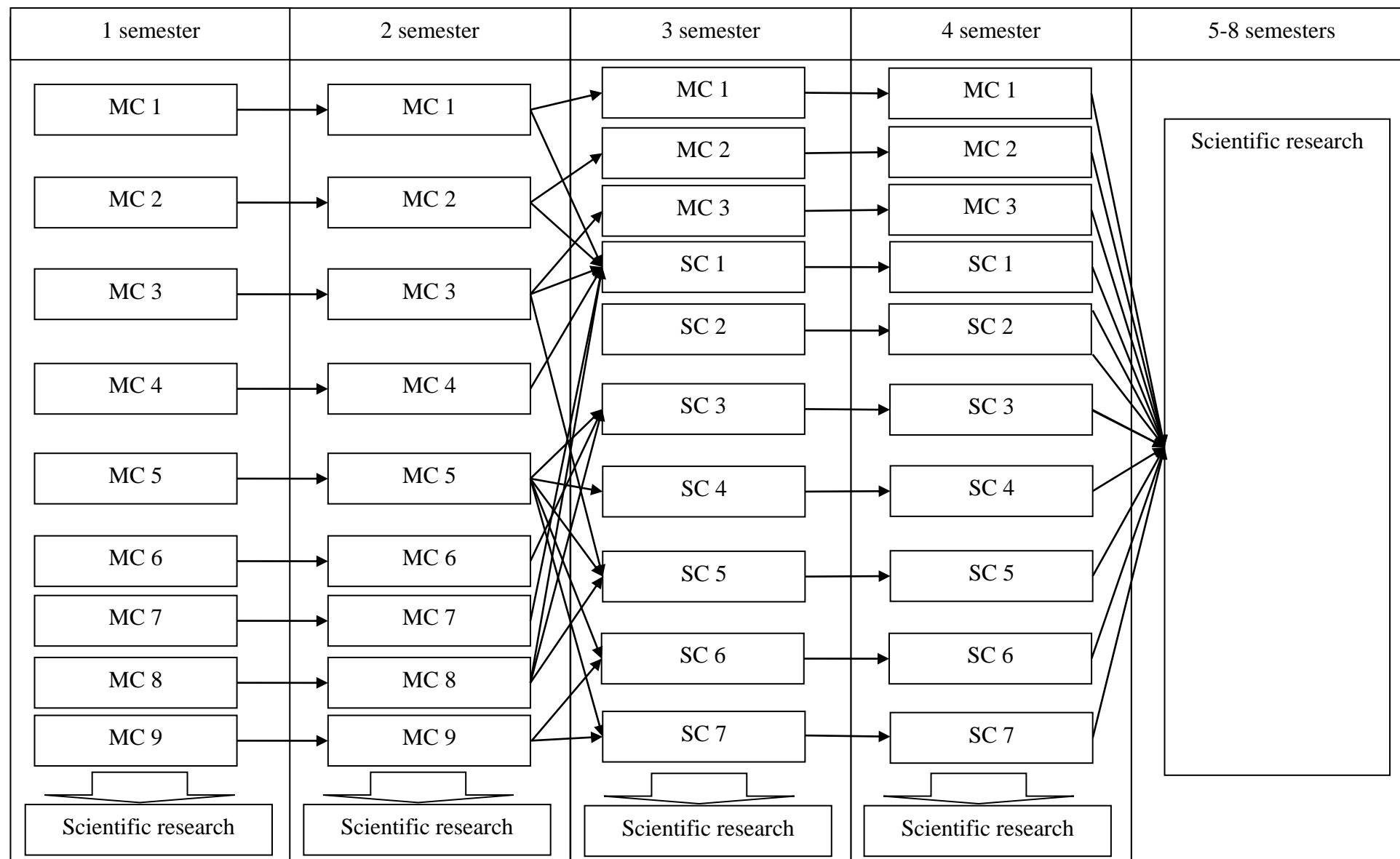
## 2. The list of educational and scientific program components and its logical sequence

### 2.1 The list of educational and scientific program components

N/A code	Educational program components (academic disciplines, course projects (works), practices, qualification work)	Number of credits	Form summary Control
<b>Mandatory components of the educational and scientific program</b>			
<b>1. Gaining in-depth knowledge of the specialty</b>			
MC 1	Conceptual problems in the field of information technology and systems	4	DT
MC 2	Theoretical foundations of military science research in the field of information technology and systems	4	E
MC 3	Mathematical modeling in the field of information technology and systems	4	E
<b>1. Obtaining general scientific (philosophical) competencies</b>			
MC 4	Philosophy and methodology of science	3	E
MC 5	Methodology of scientific and pedagogical activity	3	E
<b>2. Gaining universal researcher skills</b>			
MC 6	Basics of working with research projects and scientometric databases	3	DT
MC 7	Application of modern information technologies in scientific activities	3	E
<b>3. Getting language competencies</b>			
MC 8	Foreign language in scientific activity	6	E
<b>5. Practice</b>			
MC 9	Pedagogical (research) practice	4	Report
<b>Scope of the mandatory components:</b>		<b>34</b>	
<b>6. Scientific component</b>			
	Scientific research	<b>194</b>	Defence
<b>Selective components of the educational and scientific program</b>			
<b>1. Gaining in-depth knowledge of information systems and technologies</b>			
SC 1	Conceptual Problems of Organization of Information and Communication Systems for Military Purposes	3	DT
SC 2	Conceptual Problems of Organizing the Security of the Information Space of the Armed Forces	3	DT
<b>2. Mastering general scientific (philosophical) competencies</b>			
SC 3	Philosophy of war and peace	3	DT
<b>3. Acquiring universal research skills</b>			
SC 4	Contemporary pedagogical rhetoric	3	E
SC 5	Teaching methods in higher education	3	DT
<b>4. Practice</b>			
SC 6	Pedagogical practice (additional)	3	Report
SC 7	Research practice (additional)	3	Report
<b>Total amount of elective components that an applicant can choose</b>		<b>12</b>	

<b>TOTAL VOLUME OF THE EDUCATIONAL AND SCIENTIFIC PROGRAM</b>	<b>46</b>	
<p><b>General procedure for choosing academic disciplines.</b> The applicant chooses academic disciplines with a total number of 9 ECTS credits from the elective component of this EPP and the proposed additional list of primary disciplines (appendix to the curriculum) taught at the second (master's) level of higher education at the National Defense University of Ukraine, provided that they are relevant to the subject of the applicant's dissertation research and are not included in the completed curricula for obtaining operational and strategic levels of military education. Moreover, you can choose either pedagogical and methodological or scientific and organizational practice in the amount of 3 ECTS credits. Or the applicant can form his/her own block of elective disciplines. Moreover, the applicant has the right to choose individual modules (topics) from academic disciplines in agreement with the teacher and supervisor of the form and procedure for reporting on a separate module (topic). The total amount of elective components is 12 ECTS credits.</p>		

## 2.2 Organizational and logical scheme of the educational and scientific program





Semester	Educational components
1	Philosophy and methodology of science Methodology of scientific and scientific-pedagogical activity Foreign language in scientific activity Basics of working with scientific projects and scientometric databases Application of modern information technologies in scientific activity Conceptual problems in the field of information technologies and systems Theoretical foundations of military scientific research in the field of information technology and systems Mathematical modeling in the field of information technology and systems Conducting scientific research
2	Philosophy and methodology of science Methodology of scientific and scientific-pedagogical activity Foreign language in scientific activity Basics of working with scientific projects and scientometric databases Application of modern information technologies in scientific activity Conceptual problems in the field of information technologies and systems Theoretical foundations of military scientific research in the field of information technology and systems Mathematical modeling in the field of information technology and systems Conducting scientific research
3	Conceptual problems in the field of information technology and systems Theoretical foundations of military-scientific research in the field of information technologies and systems Mathematical modeling in the field of information technology and systems Elective disciplines for obtaining in-depth knowledge, including from other levels and educational programs Philosophy of war and peace Modern pedagogical rhetoric Methods of teaching in higher education Pedagogical or research practice Conducting scientific research
4	Conceptual problems in the field of computer science and information technology Theoretical foundations of military science research in the field of information technology and systems Mathematical modeling in the field of information technology and systems Elective disciplines for obtaining in-depth knowledge, including from other levels and educational programs Philosophy of war and peace Modern pedagogical rhetoric Methods of teaching in higher education Pedagogical or research practice Conducting scientific research
5-8	Conducting scientific research

### 3. Form of certification of higher education applicants

The certification is carried out openly and publicly, subject to the requirements of the legislation of Ukraine on the protection of state secrets.

A mandatory condition for admission to the defense is the successful completion by the adjunct of his/her individual curriculum and individual research plan.

The certification ends with the issuance of a document of the established form on awarding the degree of Doctor of Philosophy to the applicant.

<b>Form of certification of higher education applicants</b>	Certification is carried out in the form of a public defense of the dissertation.
<b>Requirements for qualification work</b>	<p>The dissertation for the degree of Doctor of Philosophy is an independent detailed scientific research that should solve significant problems and/or issues in the field of information technology and systems or on its border with other specialties of the field of knowledge 12 "Information Technology", which involves the expansion and reassessment of existing knowledge and professional practices.</p> <p>The dissertation should not contain academic plagiarism, falsification, or fabrication.</p> <p>The dissertation must be posted on the website or in the public repository of the higher education institution (research institution) or its structural unit.</p>

### 5. Matrix of correspondence of program competencies to the components of the educational and scientific program

	MC 1	MC 2	MC 3	MC 4	MC 5	MC 6	MC 7	MC 8	MC 9	SC 1	SC 2	SC 3	SC 4	SC 5	SC 6	SC 7
GC01	+			+	+	+	+			+						
GC02	+	+	+				+	+	+	+						+
GC03		+			+	+	+									+
GC04	+							+					+	+	+	
GC05		+		+	+								+	+	+	
GC06	+		+						+	+	+	+				
SC01		+	+							+	+					+
SC02		+	+				+		+	+						+
SC03	+		+				+		+	+				+		+
SC04		+	+		+	+	+			+	+					+
CK05					+			+				+	+	+	+	
SC06		+	+			+	+		+	+						+
SC07		+				+	+				+					+
SC08	+	+	+			+	+			+						+
SC09		+	+				+				+					+

SC10			+							+	+						+
SC11	+									+	+						+
SC12		+								+	+						+
SC13								+		+	+						+
SC14			+					+		+		+					+
SC15		+						+		+							+

**6. Matrix of ensuring program learning outcomes with relevant components of the educational and scientific program**

	MC 1	MC 2	MC 3	MC 4	MC 5	MC 6	MC 7	MC 8	MC 9	SC 1	SC 2	SC 3	SC 4	SC 5	SC 6	SC 7	
LO01	+				+												+
LO02				+	+			+				+	+	+	+		
LO03								+	+				+	+	+		
LO04	+						+			+							+
LO05	+				+	+											+
LO06				+		+		+				+	+	+	+		
LO07					+			+	+				+	+	+		
LO08		+							+	+	+						+
LO09	+		+					+		+							+
LO10		+						+		+	+						+
LO11		+			+						+						+
LO12			+					+		+							+
LO13		+							+	+							+
LO14			+					+	+		+						+
LO15			+						+	+							+
LO16	+	+								+							+
LO17			+			+				+	+						+
LO18	+							+		+							+
LO19		+						+		+							+
LO20			+					+		+							+

### **List of research areas of higher education applicants**

1. Development of theoretical foundations for the creation and application of information technologies, information and telecommunication (information, geoinformation) systems, automated control systems and information (cyber) security systems, electromagnetic warfare of the security and defense sector to automate the processes of troop management.

2. Development of theoretical foundations for building information technologies for automation of functional tasks of management, analysis and evaluation of the effectiveness of automated information processing systems in the command and control system of troops.

3. Research of the problems of increasing the efficiency of information and telecommunication (information, geoinformation) systems, automated control systems and information (cyber) security systems, electromagnetic warfare for military purposes.

4. Creation of information technologies for system analysis, research, development of architecture and methods of building military systems and networks with distributed databases and knowledge in the system of command and control of troops.

5. Development of information retrieval and expert information processing systems for decision-making in the command and control system of troops, as well as knowledge of oriented decision support systems under conditions of risk and uncertainty as intelligent information technologies.

6. Development of information technologies for the construction and implementation of: automated technical diagnostic systems, geographic information systems for military purposes.

7. Study of cybersecurity issues in the security and defense sector of the state, basics of cyber defense, organization of work of military command and control bodies in preparation and conduct of cyber defense, assessment of their effectiveness.

8. Development of methods for assessing the effectiveness of telecommunication and information (geoinformation) systems in the context of electromagnetic and cyber impact. Research of the problem of development of methods and ways of information protection in the management systems of the security and defense sector.

9. Development of models and methods for automation of functions and tasks in command and control systems based on the creation and use of new information technologies.

10. Research and development of information technologies for the development and implementation of databases and data warehouses, knowledge bases and decision support systems in automated command and control systems.

11. Development of artificial intelligence systems for military purposes to improve the effectiveness of command and control of troops (forces). Development of methods of mathematical modeling of operations (combat, specific actions), all types of their support.

12. Methodological and organizational foundations for the creation and combat use of advanced information technologies, information and telecommunication (information, geoinformation) systems, automated control systems and information (cyber) security systems, special-purpose electromagnetic warfare. Operational and tactical aspects of their development and improvement.

13. Study of the problems of analysis and assessment of information security of the state and substantiation of new forms and methods of implementation of military policy in the information sphere through the development of new information technologies.

14. Creation of mathematical and software for modeling processes, situations and information threats to the state in the military sphere, forecasting their development based on advanced methods of information processing under conditions of uncertainty.