MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

Kharkiv National University of Radio Electronics

EDUCATIONAL-PROFESSIONAL PROGRAM

«APPLIED COMPUTER SCIENCE»

First (Bachelor's) level of higher education

Programme Subject Area F3 Computer Science

Field of Study F Information Technologies

Qualification: Bachelor of Computer Science

APPROVED BY THE ACADEMIC COUNCIL OF NURE

Head of the Academic Council_____Igor RUBAN

(Protocol of «_27_» _02____ 2026 № _3_)

The educational program comes into effect on September 1, 2026.

Rector_____Igor RUBAN

(By Order No._103_ of «_04_» __03_____2026)

Kharkiv 2026

APPROVAL SHEET

of the Educational and Professional Program
"Applied Computer Science"
Specialty F3 Computer Science
First (Bachelor's) Level of Higher Education

AGREED

First Vice-Rector

_____ Andriy YEROKHIN

«12» 02 2026

Head of the LA and IQAD

_____ Hanna TUHAI

«09» 02 2026

Head of Educational Department

_____ Alina MIKHNOVA

«10» 02 2026

Considered at the meeting of the Academic Council of the Faculty of Computer Science
Protocol of «15» December 2025 № 1
Dean of the Faculty of CS

_____ Oleg ZOLOTUKHIN

Considered at the meeting of the Department of SE
Protocol of «14» November 2025 № 5
Head of the Department of SE

_____ Igor GREBENNIK

Stakeholder Representatives

Director of Telesens IT LLC

_____ Olesia ULIANOVA

Student Representative

Head of the Student Senate of the Faculty of CS

_____ Anna RAZUMOVSKA

DEVELOPED BY

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Igor GREBENNIK

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PREFACE

Developed by the Project Group consisting of:

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Alina Mikhnova, Candidate of Technical Sciences, Associate Professor of Information Control Systems Department (ICS), CS Faculty NURE.

Head of the Project Group:  Ihor GREBENNIK

1. Profile of the Educational Program "Applied Computer Science" in Specialty F3 Computer Science

1 – General Information	
Full name of the higher education institution and the structural unit	Kharkiv National University of Radio Electronics Computer Science Faculty, Department of Computer Modeling and Intelligent Technologies
Higher education degree and title of qualification in the original language	Bachelor Bachelor of Computer Science
Official name of the educational program	Applied Computer Science
Type of diploma and the scope of the educational program	Bachelor's diploma, single, 240 ECTS credits, duration of study: 3 years and 10 months.
Accreditation status	The accreditation certificate for the educational program is absent
Cycle/Level	NQF of Ukraine – Level 6; FQ-EHEA – First Cycle; EQF-LLL – Level 6.
Prerequisites	Complete general secondary education
Language(s) of instruction	Ukrainian, English, German
Validity period of the educational program	Until the full completion of the study period or the next update of the program.
Permanent website link	https://nure.ua/abituriyentam/spetsialnosti-ta-spetsializatsiyi/spetsialnist-f3-komp-iuterni-nauky/bakalavr-f3-komp-iuterni-nauky/prykladny-komputerni-nauky
2 - Purpose of the Educational Program	
The purpose of the program is to train highly qualified specialists in Computer Science who possess fundamental knowledge of modeling and algorithm development and are capable of designing, implementing, and adapting intelligent data processing systems to solve complex applied problems in high-tech sectors, particularly in biomedicine and industrial automation.	
3 - Characteristics of the Educational Program	
Subject area (field of study, specialty)	F Information Technology, F3 Computer Science
Orientation of the educational program	Educational and professional program. The program focuses on forming specialists with skills in the convergence of digital technologies with physical and biological systems.
Main focus of the educational program	General higher education of the first (Bachelor's) level in the field of F Information Technology, specialty F3 Computer Science.

	Keywords: systems approach, algorithm theory, systems modeling, databases and knowledge bases, CASE tools for information systems design, high-performance computing, applied and specialized software, intelligent decision support systems, biomedical data, digital manufacturing.
Peculiarities of the program	Instruction of disciplines in EU languages (English, German). Focused on establishing partnerships with domestic and international educational and scientific institutions, researchers, and practitioners; participating in international programs aimed at enhancing education quality and integrating into the European Higher Education Area (EHEA).
4 - Suitability of Graduates for Employment and Further Education	
Suitability for employment	Job titles according to the National Classifier of Occupations of Ukraine (DK 003:2010 as amended by Order No. 1410 of the Ministry of Economy of Ukraine dated 16.01.24): **213 Professionals in computing (computerization)** **2131 Professionals in computing systems:** 2131.2 Database Administrator; 2131.2 System Administrator; 2131.2 Computer Systems Analyst; 2131.2 Data Analyst; 2131.2 Mobile Applications Analyst; 2131.2 Automation Process Analyst; 2131.2 Support Engineer; 2131.2 Artificial Intelligence Engineer; 2131.2 Software Engineer. **2132 Professionals in programming:** 2132.2 Software Architect (Information Technology); 2132.2 Software Developer.
Further education	Continuation of studies in programs of the second (Master's) level of higher education.
5 - Teaching and Assessment	
Teaching and learning	Lectures, practical classes, laboratory works, seminars, independent study using textbooks, manuals, and lecture notes, consultations with teachers, pre-graduation internship, and preparation of a qualification thesis.
Assessment	Assessment of students' academic achievements is carried out according to the national scale (excellent, good, satisfactory, unsatisfactory; pass, fail); 100-point scale and ECTS scale (A, B, C, D, E, FX, F).
6 - Program Competencies	
Integral Competency	The ability to solve complex specialized tasks and practical problems in the field of Computer Science or in the learning process, which involves the application of theories and methods of Information Technology and is characterized by the complexity and uncertainty of conditions.
General Competencies	1. Ability to think abstractly, analyse, and synthesize. 2. Ability to apply knowledge in practical situations. 3. Knowledge and understanding of the subject area and understanding of professional activity. 4. Ability to communicate in the state language, both orally and in writing.

	5. Ability to communicate in a foreign language. 6. Ability to learn and master modern knowledge. 7. Ability to search, process, and analyse information from various sources. 8. Ability to generate new ideas (creativity). 9. Ability to work in a team. 10. Ability to be critical and self-critical. 11. Ability to make informed decisions. 12. Ability to evaluate and ensure the quality of performed work. 13. Ability to act on the basis of ethical considerations. 14. Ability to realize one's rights and duties as a member of society, to be aware of the values of a civil (free democratic) society and the necessity of its sustainable development, the rule of law, and human and civil rights and freedoms in Ukraine. 15. Ability to preserve and enhance moral, cultural, and scientific values and achievements of society based on an understanding of the history and patterns of the subject area development, its place in the general system of knowledge about nature and society, and in the development of society, engineering, and technology; to use various types and forms of physical activity for active rest and maintaining a healthy lifestyle. 16. Ability to make decisions and act in accordance with the principle of zero tolerance for corruption and any other manifestations of integrity violation.
Special (Professional) Competencies of the Specialty	1. Ability to mathematically formulate and study continuous and discrete mathematical models, justify the choice of methods and approaches for solving theoretical and applied problems in the field of computer science, analysis and interpretation. 2. Ability to identify statistical regularities of non-deterministic phenomena, apply computational intelligence methods, including statistical, neural network, and fuzzy data processing, machine learning methods, and genetic programming, etc. 3. Ability to think logically, construct logical conclusions, use formal languages and models of algorithmic computations, design, develop, and analyse algorithms, evaluate their efficiency and complexity, and evaluate the solvability and insolvability of algorithmic problems for adequate modeling of subject areas and creating software and information systems. 4. Ability to use modern methods of mathematical modeling of objects, processes, and phenomena, develop models and algorithms for numerical solving of mathematical modeling problems, taking into account errors of approximate numerical solving of professional tasks. 5. Ability to provide a formalised description of operations research tasks in organisational-technical and socio-economic systems for various purposes, determine their optimal solutions, build optimal control models considering changes in the economic situation, and optimise management processes in systems of various purposes and hierarchy levels. 6. Ability to apply systems thinking, applying systems analysis methodology for the study of complex problems of various nature, methods of formalisation, and solving systemic problems with conflicting goals, uncertainties, and risks.
	7. Ability to apply theoretical and practical foundations of modeling methodology and technology to study the characteristics and behaviour of complex objects and systems, conduct computational experiments with processing and analysis of results. 8. Ability to design and develop software using various programming paradigms: generalised, object-oriented, functional, logical, with appropriate models, methods, and algorithms of computation, data structures, and control mechanisms.

	9. Ability to implement a multi-level computational model based on client-server architecture, including databases, knowledge bases, and data warehouses, perform distributed processing of large data sets on clusters of standard servers to meet the computing needs of users, including cloud services. 10. Ability to apply methodologies, technologies, and tools for managing the life cycle processes of information and software systems, products, and services of information technology in accordance with the customer's requirements. 11. Ability to perform data mining based on computational intelligence methods, including large and poorly structured data, their operational processing, and visualisation of analysis results in the process of solving applied problems. 12. Ability to ensure the organisation of computational processes in information systems for various purposes, taking into account architecture, configuration, and performance indicators of operating systems and system software. 13. Ability to develop network software operating on the basis of various structured cabling system topologies, using computer systems and data transmission networks, and analysing the quality of computer network operation. 14. Ability to apply methods and tools for ensuring information security, develop and operate special software for the protection of information resources of critical information infrastructure objects. 15. Ability to analyse and perform functional modeling of business processes, construct and practically apply functional models of organisational-economic and production-technical systems, and risk assessment methods for their design.
	16. Ability to implement high-performance computing based on cloud services and technologies, parallel and distributed computing in the development and operation of distributed parallel information processing systems.
	17. Ability to implement strategies for integrating sustainable development into the life cycle of intelligent and information systems and evaluate the impact of technologies and local initiatives on achieving sustainable development goals.
Special (Professional) Competencies of the Educational Program	1. Ability to use modern data analysis methods, in particular, Data Mining and image processing, for analysis and their subsequent use in solving applied interdisciplinary tasks. 2. Ability to develop, implement, and critically evaluate machine learning solutions by applying mathematical foundations, algorithmic methods, and computational and software tools for data modeling, solving forecasting or decision-making problems, as well as assessing model performance, including considerations of generalization, limitations, and ethical implications. 3. Ability to design, implement, and evaluate machine learning solutions in automated and cyber-physical systems by integrating data-driven models with sensory control, management, and decision-making processes to enhance system performance, adaptability, and resilience while considering operational constraints, reliability, and safety. 4. Ability to design, implement, and evaluate modern web applications by integrating frontend and backend technologies, data management, and web architectures to create secure, maintainable, and user-focused solutions. This includes applying principles of human-computer interaction, human cognition, ethics, usability, accessibility, and interaction technologies. 5. Ability to analyze, design, and evaluate computational solutions for practical biomedical tasks by incorporating principles of medical data management in healthcare information systems, focusing on interoperability and data quality, as well as adhering to regulatory constraints, while also considering clinical workflows, confidentiality, and ethical issues.

	6. Ability to apply modern approaches in the development of complex software systems, in particular project management methods and mechanisms, industrial technologies, virtualisation, cloud services, and to integrate existing specialised systems with mobile technologies and services.
7 - Program Learning Outcomes	
	1. Apply knowledge of the basic forms and laws of abstract-logical thinking, fundamentals of scientific knowledge methodology, and the forms and methods of extracting, analysing, processing, and synthesizing information in the field of computer science. 2. Use modern mathematical tools from continuous and discrete analysis, linear algebra, and analytical geometry in professional work to solve both theoretical and practical problems during the design and implementation of informatization projects. 3. Apply understanding of the regular patterns of random phenomena, their characteristics, and how to manipulate them, along with models of random processes and modern software environments, to solve statistical data analysis problems and develop predictive models. 4. Use methods of computational intelligence, machine learning, neural networks, fuzzy data processing, genetic, and evolutionary programming to solve problems of recognition, forecasting, classification, identification of control objects, and more. 5. Design, develop, and analyse algorithms for solving computational and logical problems, evaluate the efficiency and complexity of algorithms based on the application of formal models of algorithms and computable functions. 6. Use methods of numerical differentiation and integration of functions, solve ordinary differential and integral equations, understand the peculiarities of numerical methods, and explore their adaptation to engineering tasks; develop skills in software implementation of numerical methods.
	7. Understand the principles of modeling organizational-technical systems and operations; apply operations research methods to solve single- and multi-criteria optimization problems involving linear, integer, nonlinear, and stochastic programming. 8. Apply systems analysis methodology to objects, processes, and systems for tasks involving analysis, forecasting, management, and design of dynamic processes in macroeconomic, technical, technological, and financial objects. 9. Develop software models of subject environments, and select a programming paradigm based on convenience and code quality for implementing methods and algorithms to solve problems in computer science. 10. Use tools for developing client-server applications, design conceptual, logical, and physical database models, develop and optimise queries, create distributed databases, data warehouses and data marts, knowledge bases, including on cloud services, using web programming languages. 11. Possess software life cycle management skills for IT products and services according to customer requirements and constraints, and be capable of developing project documentation such as feasibility studies, terms of reference, business plans, agreements, and contracts. 12. Apply methods and algorithms of computational intelligence and data mining to tasks such as classification, forecasting, cluster analysis, and searching for associative rules, using software tools for multidimensional data analysis based on DataMining, TextMining, and WebMining technologies.es.

	13. Possess knowledge of system programming languages and methods for developing programs that interact with computer system components; understand network technologies and computer network architectures; have practical skills in computer network administration and software technologies. 14. (Removed from the standard according to the Order of the MES of Ukraine No. 96 dated 26.01.2024) 15. Apply knowledge of methodology and CASE tools for designing complex systems, methods of structural systems analysis, and object-oriented design methodology in developing and studying functional models of organizational-economic and production-technical systems.ms. 16. Understand the concept of information security and principles of secure software design; ensure the security of computer networks in conditions of incomplete and uncertain initial data. 17. Perform parallel and distributed computing, implement numerical methods and algorithms for parallel architectures, and utilize parallel programming languages in developing and operating parallel and distributed software.
	18. Use technologies to support and analyse the effectiveness of sustainable development initiatives in education and the community. 19. Express thoughts clearly, have negotiation skills in both native and foreign (English) languages, work effectively with others to reach a common goal, adapt quickly to changes, manage time and priorities, analyse information, and make well-informed decisions. 20. Design machine learning tasks, choose and apply suitable methods and algorithms, train and validate models on real data, and interpret solutions while assessing their effectiveness, assumptions, risks, and potential biases. 21. Develop tasks suitable for machine learning based on technological process requirements, select and apply appropriate models, incorporate them with control or decision-making systems, and assess their effects on system behaviour through simulations or real-world scenarios focusing on performance, stability, and reliability. 22. Analyse user needs, develop comprehensive web applications and interfaces using suitable frameworks, programming technologies, and cloud services; assess them for functionality, security, usability, and performance, while considering human factors, accessibility, and context. 23. Apply modern methods, technologies, and software tools for data and knowledge processing to model, manage, and analyse biomedical data, ensuring usability, integrity, interoperability, and compliance with legal and ethical standards. 24. Be able to assess the ethical, social, and legal impacts of creating and deploying artificial intelligence systems, while recognizing professional responsibility for the technical decisions made.de.
8 – Resource Support for Program Implementation	
Staffing	The program's implementation is guaranteed by highly qualified staff with academic degrees and titles, who have extensive experience in teaching, methodology, and research, and meet the qualification requirements for the specialty in accordance with licensing standards.
Facilities and Resources	1. Provision of premises for conducting educational classes and assessment activities. 2. Provision of multimedia equipment for simultaneous use in classrooms. 3. Availability of social and domestic infrastructure. 4. Provision of dormitories for higher education students.

	5. Provision of computer workstations, laboratories, and equipment necessary for the implementation of curricula.
Information and Teaching Methodology Support	1. Providing the library with domestic and foreign professional periodicals in relevant or related fields, including electronic versions. 2. Availability of access to English-language databases of scientific periodicals in relevant or related fields. 3. Availability of an official website of the educational institution that provides key information about its activities, including its structure, licenses and accreditation certificates, educational, research, publishing, and certification activities, academic and scientific units and their composition, list of disciplines, admission rules, and contact details. 4. Availability of a website for the graduating department that contains information on educational activities (such as educational programs and curricula, public discussions, stakeholder reviews, student and teacher surveys, elective components, and instruction in English, consultation schedules, qualification thesis defence and methodological materials), research activities (including research and teaching laboratories, student clubs, research and development outcomes, and key staff publications), and international activities (like partnerships, projects, and accreditation results).. 5. Availability of an institutional electronic resource containing teaching and methodological materials for the curriculum's disciplines, including those within the distance learning system.
9 - Academic Mobility	
National Credit Mobility	Based on bilateral agreements between Kharkiv National University of Radio Electronics and other higher education institutions in Ukraine.
International Credit Mobility	Based on bilateral agreements between Kharkiv National University of Radio Electronics and foreign higher education institutions.
Instruction for Foreign Higher Education Students	Based on agreements between Kharkiv National University of Radio Electronics and foreign higher education institutions.

2. List of Educational Components and Their Logical Sequence

2.1. List of Educational Components of the Educational Program

Table – List of Educational Components of the Educational Program

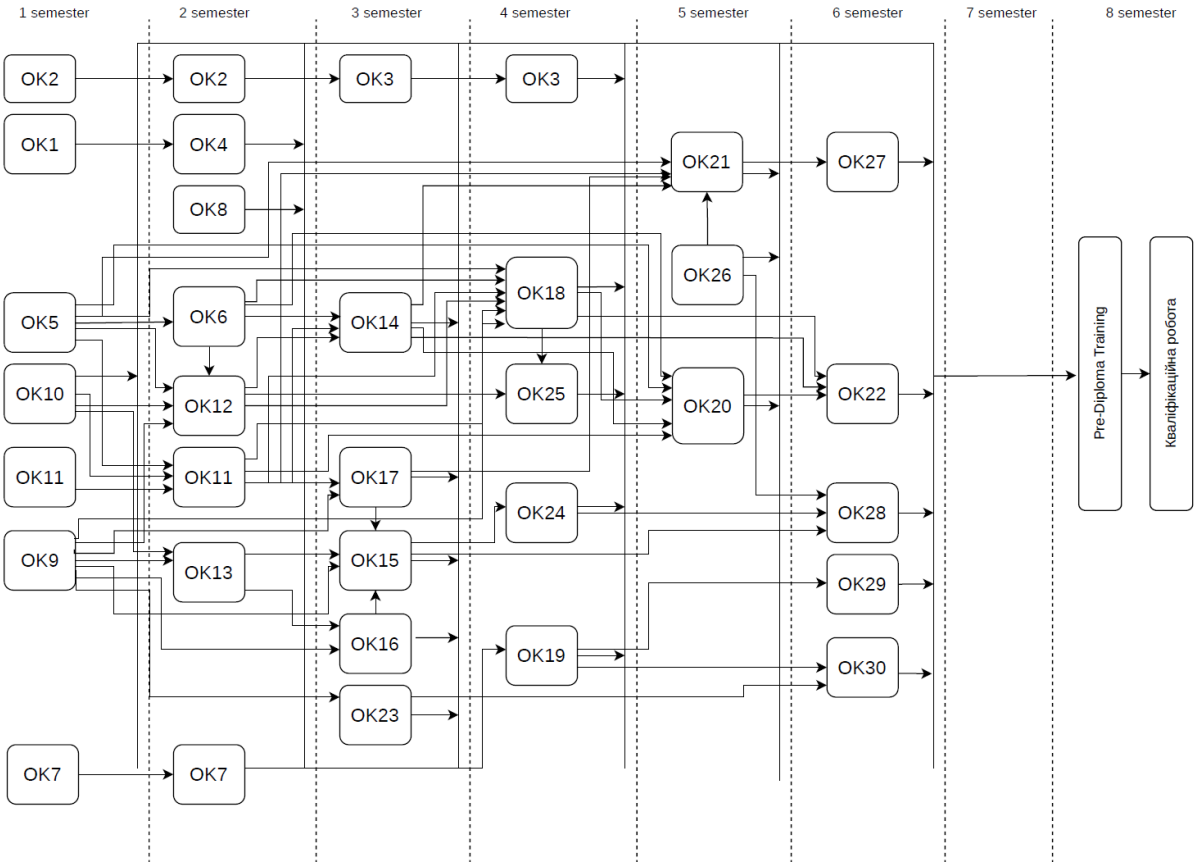
Component Code	Educational components (academic disciplines, course papers (projects), internships, qualification thesis)	Number of credits	Form of final control
1	2	3	4
MANDATORY COMPONENTS OF THE EP			
GENERAL AND SPECIAL (PROFESSIONAL) TRAINING CYCLE			
Humanities and socio-economic disciplines			
OK 1	Professional Ukrainian Language	4	Pass
OK 2	Foreign Language	4	Exam
OK 3	Foreign Language (Deutsch)	7	Exam
OK 3*	Ukrainian as a Foreign Language	12	Exam
OK 4	Basics of Law	2	Pass
Natural and scientific (fundamental) disciplines			
OK 5	Linear Algebra and Analytic Geometry	6	Exam
OK 6	Mathematical Analysis	6	Exam
OK 7	Physics	6	Exam
Basic (professional) training disciplines by Programme Subject Area			
OK 8	Economics and Business	3	Pass
OK 9	Algorithmic Techniques and Programming	6	Exam
OK 10	Theory of Algorithms	4	Pass
OK 11	Discrete Mathematics for Computer Science	9	Exam
OK 12	Numerical Methods for Computer Science	5	Pass
OK 13	Object-Oriented Programming	5	Exam
OK 14	Probability, Statistics and Random Processes for Computer Science	5	Exam
OK 15	Cross-Platform Programming	5	Exam
OK 16	Web Technology and Web Design	5	Pass
OK 17	Data Bases Fundamentals	5	Exam
OK 18	Operations Research	5	Exam
OK 19	Computer Architecture and Networks	5	Exam
OK 20	System Analysis	5	Exam
OK 21	Data Intelligence	5	Pass
OK 22	Decision-Making Theory	5	Exam
CYCLE OF PROFESSIONAL TRAINING			
Disciplines of professional and practical training according to the Educational Program «Applied Computer Science»			
OK 23	Operating Systems and Computing	5	Pass
OK 24	Computer-aided systems design	5	Pass
OK 25	System Modeling	5	Pass
OK 26	Basics of artificial intelligence	5	Exam
OK 27	Data Visualization Methods	5	Exam
OK 28	Software System Engineering	5	Pass
OK 29	Basics of Cybersecurity	5	Exam
OK 30	Parallel and Distributed Computing	5	Exam
OK 31	Pre-Diploma Training	10	Pass
OK 32	Bachelor's Thesis	12	Exam

Total volume of mandatory components		**174**	
ELECTIVE COMPONENTS OF THE EP**			
GENERAL AND SPECIAL (PROFESSIONAL) TRAINING CYCLE			
Humanities and socio-economic disciplines			
ВК 1	Foreign Language for professional communication (Deutsch)	5	Pass
ВК 2	Disciplines from the general catalog of optional educational disciplines	5	Pass
CYCLE OF PROFESSIONAL TRAINING			
Disciplines of professional and practical training according to the Educational Program «Applied Computer Science»			
ВК 3	Specialized Algorithmic Structures	5	Pass
ВК 4	Programming Languages for Data Analysis	5	Pass
ВК 5	Project Management	5	Pass
ВК 6	Java Enterprise	5	Pass
ВК 7	Data Processing using Python	5	Pass
ВК 8	Artificial Intelligence Ethics	5	Pass
ВК 9	Image processing for Life Science	5	Pass
ВК 10	Business analysis in automation system design	5	Pass
ВК 11	Cloud Technology	5	Pass
ВК 12	Basics of Automation	5	Pass
ВК 13	Data Analysis	5	Exam
ВК 14	Human-Machine Interaction	5	Exam
ВК 15	Cyber-Physical Systems	5	Pass
ВК 16	Machine Learning	5	Exam
ВК 17	Robotic Systems	5	Pass
ВК 18	Medical Informatics	5	Pass
ВК 19	Bioinformatics	5	Pass
ВК 20	Applied Artificial Intelligence	5	Pass
ВК 21	Virtual and Complementary Reality	5	Pass
ВК 22	Agent and Distributed Systems	5	Pass
ВК 23	Web Applications Development	5	Pass
ВК 24	Machine Learning for Automation	5	Pass
ВК 25	Mathematical Foundations of Artificial Neural Networks	5	Pass
	Disciplines from the general catalog of optional educational disciplines		Pass
Total volume of elective components		**63**	
The discipline is required for applicants of higher education in accordance with the Resolution of the Cabinet of Ministers of Ukraine dated 21.06.2024 № 734 «On the Approval of the Procedure for Conducting Basic General Military Training for Citizens of Ukraine Pursuing Higher Education and Police Officers»			
	Basic Combined Arms Training (theoretical training)	3	Dif.Pass
	Basic Combined Arms Training (practical training)	7	
TOTAL VOLUME OF EDUCATIONAL COMPONENTS OF THE EP		**240**	
ОК 33	Physical Training (in students' free time)	0	Pass

* For foreign applicants of higher education

**The list of optional components is proposed by the Department and can be supplemented in the working study plan from the general catalog of optional disciplines of the University - in the case of a choice by applicants of higher education

2.2 Structural-Logical Scheme of the Educational Program



3. Attestation of Higher Education Students

The attestation process for higher education students in the "Applied Computer Science' program under the specialty F3 Computer Science involves the public defense of a qualification thesis. This is followed by the issuance of a document in the established format that confers the Bachelor's degree and the educational qualification: Bachelor of Computer Science.

Form of attestation:

The attestation is conducted through a public defense of a qualification thesis.

Requirements for the Qualification Thesis

The qualification thesis must demonstrate:

– the graduate's ability to solve topical problems in the development and implementation of computer systems based on the use of fundamental and specialized applied methods of computer science, which enables the effective performance of practical tasks;

– the ability to use acquired competencies and learning outcomes to logically justify design solutions based on modern scientific methods, draw reasoned conclusions, and formulate specific proposals and recommendations regarding the task solved.

The qualification thesis must not contain academic plagiarism, fabrication, or falsification.

The qualification thesis must be published in the institutional repository of the higher education institution.

4. Matrix of Correspondence between Competencies and Educational Components of the Program

Table 4.1 – Matrix of Correspondence between General (ЗК) and Specialist (ФК) Competencies and Mandatory Educational Components (ОК) of the Educational Program

	ОК 1	ОК 2	ОК 3	ОК 3*	ОК 4	ОК 5	ОК 6	ОК 7	ОК 8	ОК 9	ОК 10	ОК 11	ОК 12	ОК 13	ОК 14	ОК 15	ОК 16	ОК 17	ОК 18	ОК 19	ОК 20	ОК 21	ОК 22	ОК 23	ОК 24	ОК 25	ОК 26	ОК 27	ОК 28	ОК 29	ОК 30	ОК 31	ОК 32	ОК 33
ЗК 1						+	+	+		+	+	+	+	+	+	+	+		+		+	+	+		+	+	+		+		+	+	+	
ЗК 2						+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
ЗК 3									+					+		+	+		+		+	+		+	+	+		+	+	+	+	+	
ЗК 4	+																														+	+	
ЗК 5		+	+	+																								+			+	+	
ЗК 6		+	+	+											+							+		+		+	+					+	+	
ЗК 7	+	+	+	+	+										+									+		+						+	+	
ЗК 8					+											+						+				+			+			+	+	
ЗК 9																									+				+					+
ЗК 10					+																+	+	+						+			+	+	
ЗК 11						+	+	+	+		+	+	+						+		+		+	+		+			+	+		+	+	
ЗК 12										+				+			+					+							+		+	+	+	
ЗК 13					+				+													+					+			+		+	+	
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ЗК 16					+									+				+							+				+			+	+	
ФК 1						+	+	+				+	+						+			+	+			+						+	+	
ФК 2															+							+					+					+	+	
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Table 4.2 – Matrix of Correspondence between General (ЗК) and Specialist (ФК) Competencies and Elective Educational Components (ВК) of the Educational Program

	ВК 1	ВК 2	ВК 3	ВК 4	ВК 5	ВК 6	ВК 7	ВК 8	ВК 9	ВК 10	ВК 11	ВК 12	ВК 13	ВК 14	ВК 15	ВК 16	ВК 17	ВК 18	ВК 19	ВК20	ВК 21	ВК 22	ВК 23	ВК 24	ВК 25
ЗК 1			+	+						+		+	+		+	+	+								+
ЗК 2	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+			+	+	+	+	+	+
ЗК 3				+	+				+	+		+		+	+		+	+	+				+	+	
ЗК 4		+																							
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ФК 2									+							+		+	+	+				+	
ФК 3			+																						
ФК 4																									
ФК 5																									
ФК 6										+		+			+		+								
ФК 7																								+	
ФК 8				+			+							+									+		
ФК 9						+					+	+				+					+		+		
ФК 10					+																				
ФК 11							+		+				+			+				+					
ФК 12																						+			
ФК 13																									
ФК 14																									
ФК 15												+													
ФК 16											+											+			
ФК 17															+			+							
ФК 18							+		+				+						+	+					+
ФК 19				+				+								+				+				+	+
ФК 20										+		+			+		+			+					+
ФК 21														+									+		
ФК 22								+		+								+	+						
ФК 23					+	+					+										+	+			

6. Matrix of Providing Program Learning Outcomes (ПРН) by Relevant Educational Components of the Educational Program

Table 5.1 – Matrix of Providing Program Learning Outcomes (ПРН) by Mandatory Educational Components (ОК) of the Educational Program

	ОК 1	ОК 2	ОК 3	ОК 3*	ОК 4	ОК 5	ОК 6	ОК 7	ОК 8	ОК 9	ОК 10	ОК 11	ОК 12	ОК 13	ОК 14	ОК 15	ОК 16	ОК 17	ОК 18	ОК 19	ОК 20	ОК 21	ОК 22	ОК 23	ОК 24	ОК 25	ОК 26	ОК 27	ОК 28	ОК 29	ОК 30	ОК 31	ОК 32	ОК 33
ПРН 1	+	+	+	+	+	+	+	+	+		+	+							+		+	+										+	+	
ПРН 2						+	+	+				+							+													+	+	
ПРН 3															+							+										+	+	
ПРН 4																						+					+					+	+	
ПРН 5										+	+	+																				+	+	
ПРН 6													+																			+	+	
ПРН 7																			+				+			+						+	+	
ПРН 8									+												+		+			+						+	+	
ПРН 9										+				+		+	+														+	+	+	
ПРН 10																+		+							+							+	+	
ПРН 11									+																				+			+	+	
ПРН 12																						+						+				+	+	
ПРН 13																				+				+								+	+	
ПРН 15																									+				+			+	+	
ПРН 16																				+										+		+	+	
ПРН 17																														+	+	+	+	
ПРН 18									+																							+	+	
ПРН 19	+	+	+	+	+				+																							+	+	+
ПРН 14. Removed from the standard according to the Order of the MES of Ukraine No. 96 dated 26.01.2024																																		

Table 5.2 – Matrix of Providing Program Learning Outcomes (ПРН) by Elective Educational Components (ВК) of the Educational Program

	ВК 1	ВК 2	ВК 3	ВК 4	ВК 5	ВК 6	ВК 7	ВК 8	ВК 9	ВК 10	ВК 11	ВК 12	ВК 13	ВК14	ВК 15	ВК 16	ВК 17	ВК 18	ВК 19	ВК 20	ВК 21	ВК 22	ВК 23	ВК 24	ВК 25
ПРН 1	+								+	+		+													
ПРН 2			+																						
ПРН 3																									
ПРН 4								+	+							+		+	+	+				+	+
ПРН 5																									
ПРН 6																									
ПРН 7																									
ПРН 8										+		+			+		+								
ПРН 9				+		+	+							+							+				
ПРН 10											+												+		
ПРН 11					+																				
ПРН 12													+					+	+	+		+			
ПРН 13																									
ПРН 15																									
ПРН 16																									
ПРН 17																						+			
ПРН 18		+			+			+						+				+	+						
ПРН 19	+	+																	+	+					
ПРН 20													+			+		+	+	+				+	+
ПРН 21					+					+		+			+	+	+			+				+	
ПРН 22						+				+				+							+		+		
ПРН 23				+			+	+	+		+		+					+	+		+				
ПРН 24								+										+							
ПРН14. Removed from the standard according to the Order of the MES of Ukraine No. 96 dated 26.01.2024																									

6. Matrix of Correspondence between Competencies and NQF Descriptors

Table – Matrix of Correspondence between Competencies and NQF Descriptors

Classification of Competencies according to the NQF	**Knowledge** **Kn1** Conceptual scientific and practical knowledge. **Kn2** Critical understanding of theories, principles, methods, and concepts in the field of professional activity and/or study.	**Skills** **Sk1** Advanced cognitive and practical skills, mastery and innovation at the level required to solve complex specialised tasks and practical problems in the field of professional activity or study.	**Communication** **C1** Communicating information, ideas, problems, solutions, personal experience, and arguments to both specialists and non-specialists. **C2** Collection, interpretation, and application of data. **C3** Communication on professional issues, including in a foreign language, both orally and in writing.	**Autonomy and Responsibility** **AR1** Management of complex technical or professional activities or projects. **AR2** The ability to assume responsibility for decision-making in unpredictable work and/or study contexts. **AR3** Making judgments that consider social, scientific, and ethical factors. **AR4** Organizing and managing the professional development of individuals and groups. **AR5** The ability to continue learning independently with a high level of autonomy.
General Competencies				
3K1. Ability to think abstractly, analyse, and synthesize.		**Sc1**		
3K2. Ability to apply knowledge in practical situations.	**Kn1**	**Sc1**		**AR1**

3К3. Knowledge and understanding of the subject area and understanding of professional activity	**Kn1**			
3К4. Ability to communicate in the state language, both orally and in writing.			**C1**	
3К5. Ability to communicate in a foreign language.			**C1**	
3К6. Ability to learn and master modern knowledge.				**AR5**
3К7. Ability to search, process, and analyse information from various sources	**Kn2**		**C2**	**AR3**
3К8. Ability to generate new ideas (creativity).		**Sc1**		
3К9. Ability to work in a team.				**AR4Kn2**
3К10. Ability to be critical and self-critical.	**Kn2**			
3К11. Ability to make informed decisions.	**Kn2**	**Sc1**		**AR2**
3К12. Ability to evaluate and ensure the quality of performed work.				**AR1**
3К13.Ability to act on the basis of ethical considerations.				**AR3**
3К14.Ability to realize one's rights and duties as a member of society, to be aware of the values of a civil (free democratic) society and the necessity of its sustainable development, the rule of law, and human and civil rights and freedoms in Ukraine.				**AR3**
3К15.Ability to preserve and enhance moral, cultural, and scientific values and achievements of society based on an understanding of the history and patterns of the subject area development, its place in the general system of knowledge about nature and society, and in the development of society, engineering, and technology; to use various types and forms of physical activity for active rest and maintaining a healthy lifestyle.				**AR3**

3К16.Ability to make decisions and act in accordance with the principle of zero tolerance for corruption and any other manifestations of integrity violation.	**Kn1**			**AR3**
Special (Professional) Competencies of the Specialty				
ФК1. Ability to mathematically formulate and study continuous and discrete mathematical models, justify the choice of methods and approaches for solving theoretical and applied problems in the field of computer science, analysis and interpretation.	**Kn1**	**Sc1**	**C2**	
ФК2. Ability to identify statistical regularities of non-deterministic phenomena, apply computational intelligence methods, including statistical, neural network, and fuzzy data processing, machine learning methods, and genetic programming, etc.	**Kn1**	**Sc1**	**C2**	**AR5**
ФК3.Ability to think logically, construct logical conclusions, use formal languages and models of algorithmic computations, design, develop, and analyse algorithms, evaluate their efficiency and complexity, and evaluate the solvability and insolvability of algorithmic problems for adequate modeling of subject areas and creating software and information systems.	**Kn2**	**Sc1**		**AR2**
ФК4.Ability to use modern methods of mathematical modeling of objects, processes, and phenomena, develop models and algorithms for numerical solving of mathematical modeling problems, taking into account errors of approximate numerical solving of professional tasks..	**Kn1**	**Sc1**		**AR5**

ФК5. Ability to provide a formalised description of operations research tasks in organisational-technical and socio-economic systems for various purposes, determine their optimal solutions, build optimal control models considering changes in the economic situation, and optimise management processes in systems of various purposes and hierarchy levels.	**Kn1**	**Sc1**		**AR2**
ФК6. Ability to apply systems thinking, applying systems analysis methodology for the study of complex problems of various nature, methods of formalisation, and solving systemic problems with conflicting goals, uncertainties, and risks.	**Kn1**	**Sc1**		
ФК7. Ability to apply theoretical and practical foundations of modeling methodology and technology to study the characteristics and behaviour of complex objects and systems, conduct computational experiments with processing and analysis of results.		**Sc1**	**C2**	
ФК8. Ability to design and develop software using various programming paradigms: generalised, object-oriented, functional, logical, with appropriate models, methods, and algorithms of computation, data structures, and control mechanisms.		**Sc1**		
ФК 9. Ability to implement a multi-level computational model based on client-server architecture, including databases, knowledge bases, and data warehouses, perform distributed processing of large data sets on clusters of standard servers to meet the computing needs of users, including cloud services.		**Sc1**	**C2**	
ФК10. Ability to apply methodologies, technologies, and tools for managing the life		**Sc1**		**AR1**

cycle processes of information and software systems, products, and services of information technology in accordance with the customer's requirements.				
ФК11. Ability to perform data mining based on computational intelligence methods, including large and poorly structured data, their operational processing, and visualisation of analysis results in the process of solving applied problems.	**Kn1**	**Sc1**	**C2**	
ФК12. Ability to ensure the organisation of computational processes in information systems for various purposes, taking into account architecture, configuration, and performance indicators of operating systems and system software.	**Kn1**	**Sc1**		
ФК13. Ability to develop network software operating on the basis of various structured cabling system topologies, using computer systems and data transmission networks, and analysing the quality of computer network operation.		**Sc1**		
ФК14. Ability to apply methods and tools for ensuring information security, develop and operate special software for the protection of information resources of critical information infrastructure objects.		**Sc1**		
ФК15. Ability to analyse and perform functional modeling of business processes, construct and practically apply functional models of organisational-economic and production-technical systems, and risk assessment methods for their design.	**Kn2**	**Sc1**	**C2**	**AR2**
ФК16. Ability to implement high-performance computing based on cloud services	**Kn1**	**Sc1**		

and technologies, parallel and distributed computing in the development and operation of distributed parallel information processing systems.				
ФК17.Ability to implement strategies for integrating sustainable development into the life cycle of intelligent and information systems and evaluate the impact of technologies and local initiatives on achieving sustainable development goals.		**Sc1**		**AR1**
ФК18. Ability to use modern data analysis methods, in particular, Data Mining and image processing, for analysis and their subsequent use in solving applied interdisciplinary tasks	**Kn2**	**Sc1**	**C2**	**AR3**
ФК19. Ability to develop, implement, and critically evaluate machine learning solutions by applying mathematical foundations, algorithmic methods, and computational and software tools for data modeling, solving forecasting or decision-making problems, as well as assessing model performance, including considerations of generalization, limitations, and ethical implications.	**Kn2**	**Sc1**	**C2**	**AR2, AR3**
ФК20. Ability to design, implement, and evaluate machine learning solutions in automated and cyber-physical systems by integrating data-driven models with sensory control, management, and decision-making processes to enhance system performance, adaptability, and resilience while considering operational constraints, reliability, and safety.	**Kn2**	**Sc1**	**C2**	**AR1**
ФК21. Ability to design, implement, and evaluate modern web applications by integrating frontend and backend technologies, data management, and web architectures to create		**Sc1**	**C2**	**AR2**

secure, maintainable, and user-focused solutions. This includes applying principles of human-computer interaction, human cognition, ethics, usability, accessibility, and interaction technologies.				
ФК22. Ability to analyse, design, and evaluate computational solutions for practical biomedical tasks by incorporating principles of medical data management in healthcare information systems, focusing on interoperability and data quality, as well as adhering to regulatory constraints, while also considering clinical workflows, confidentiality, and ethical issues.	**Kn2**	**Sc1**		**AR1**
ФК23. Ability to apply modern approaches in the development of complex software systems, in particular project management methods and mechanisms, industrial technologies, virtualisation, cloud services, and to integrate existing specialised systems with mobile technologies and services.		**Sc1**		**AR1**

Table 7 – Matrix of Correspondence between Program Learning Outcomes and Competencies

Program Learning Outcomes	Competencies															
	Integral Competency: The ability to solve complex specialized tasks and practical problems in the field of Computer Science or in the learning process, which involves the application of theories and methods of Information Technology and is characterized by the complexity and uncertainty of conditions.															
	General Competencies															
	ЗК1	ЗК2	ЗК3	ЗК4	ЗК5	ЗК6	ЗК7	ЗК8	ЗК9	ЗК10	ЗК11	ЗК12	ЗК13	ЗК14	ЗК15	ЗК16
ПР 1	+					+	+	+			+					+
ПР 2	+	+	+	+	+	+				+		+	+	+		+
ПР 3	+	+								+		+	+	+		+
ПР 4	+	+	+					+		+		+	+	+		+
ПР 5	+	+								+		+	+	+		+
ПР 6	+	+								+				+		+
ПР 7	+	+	+			+				+				+		+
ПР 8	+	+	+	+	+	+		+	+	+		+	+	+		+
ПР 9	+	+	+			+			+	+			+	+		+
ПР 10	+	+	+						+	+	+	+	+	+	+	+
ПР 11	+	+				+			+	+				+		+
ПР 12	+	+	+			+		+		+			+	+		+
ПР 13	+	+		+	+				+	+				+		+
ПР 15	+	+								+			+	+		+
ПР 16	+	+	+				+	+			+		+			+
ПР 17	+	+		+	+	+		+	+				+			+
ПР 18	+	+	+			+		+			+	+				+
ПР 19	+	+		+	+	+	+		+		+			+	+	+
ПР 20	+	+								+	+					+
ПР 21	+	+	+								+		+			+
ПР 22		+	+					+	+			+	+			+
ПР 23	+	+	+		+	+	+		+	+	+	+	+			+
ПР 24			+										+			+

Program Learning Outcomes	Special (Professional) Competencies																							
	СК1	СК2	СК3	СК4	СК5	СК6	СК7	СК8	СК9	СК10	СК11	СК12	СК13	СК14	СК15	СК16	СК17	СК18	СК19	СК20	СК21	СК22	СК23
ПР 1	+	+	+	+	+	+	+	+			+				+	+		+		+		+	
ПР 2	+		+																				
ПР 3	+	+																					
ПР 4	+	+																					
ПР 5	+		+																				
ПР 6	+			+																			
ПР 7	+				+														+				
ПР 8	+					+																	
ПР 9							+	+													+		
ПР 10	+								+														+
ПР 11										+													
ПР 12	+										+												
ПР 13												+	+										
ПР 15										+			+		+								
ПР 16	+													+									
ПР 17	+															+							+
ПР 18															+		+						
ПР 19																		+					
ПР 20																		+	+				
ПР 21																				+		+	
ПР 22																				+	+	+	+
ПР 23																		+	+			+	+
ПР 24																			+		+	+	

ПР 14. Removed from the standard according to the Order of the MES of Ukraine No. 96 dated 26.01.2024

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