Ministry of Education and Science of Ukraine

V. N. Karazin Kharkiv National University

EDUCATIONAL AND PROFESSIONAL PROGRAM

(educational-professional / educational-scientific)

Theoretical and Applied Computer Science

(program name)

first (bachelor's) higher education level

(first (bachelor's), second (master's), third (educational and scientific)

Area of expertise 12 Information technology

(code, industry name)

Specialization 122 computer science

(code, specialty name)

Approved
By the Academic Council
Kharkiv National University
V. N. Karazin _____,

Protocol No. _____

Effective from 01.06. 2024.
by Order No. 0114-1/227 of 9.06.2022
Vice-Rector for Scientific and Pedagogical Work

_____ Oleksandr HOLOVKO

Kharkiv 2024

APPROVAL LETTER
educational and professional programs
"Theoretical and Applied Informatics"

APPROVAL LETTER
educational and professional programs"Informatics"

Educational program reviewed and approved:

1. Scientific and Methodological Council of V. N. Karazin Kharkiv National University

protocol No. ___ of _____.

Chairman of the Scientific and Methodological Council,
vice-rector with scientific and pedagogical work

_____ Oleksandr HOLOVKO

2. To the Academic Council of the Faculty of Mathematics and Informatics:

Protocol No. ___ of _____.

Chairman of the Academic Council
Faculty of Mathematics and Computer Science

_____ Grigory ZHOLTKEVICH

3. Scientific and Methodological Department of Mathematics and Informatics:

Protocol No. ___ of _____.

Chairman of the Scientific and Methodological Commission
Faculty of Mathematics and Computer Science

_____ Olga ANOSHCHENKO

4. Department of Theoretical and Applied Informatics :

Protocol No. ___ of _____.

Acting Head of the Department,

_____ Ievgen MENIAILOV

PREAMBLE

Developed by a working group consisting of:

Last name, first name, patronymic	Name of the position (for part-timers-place of main work, position)	Scientific degree, academic title, according to which the department (specialty) was awarded
Head of the working group, guarantor of the educational program		
Zaretskaya Street Irina Timofeevna	Head of the Department of Theoretical and Applied Informatics	PhD in Physical and Mathematical Sciences, 01.01.01-Mathematical analysis, Associate Professor at the Department of Higher Mathematics and Computer Science
Members of the working group		
ZHOLTKEVICH Grigory Nikolaevich	Dean of the Faculty of Mathematics and Informatics, V. N. Karazin Kharkiv National University	Doctor of Technical Sciences 05.02.08-Mechanical Engineering Technology, Professor at the Department of Theoretical and Applied Informatics
RUKKAS Kirill Markovich	professor of the Department. theoretical and applied computer science	Doctor of Technical Sciences 05.13.06-Information Technologies, Associate Professor at the Department of Tactics
MOROZOVA Anastasia Gennadievna	senior lecturer of the Department of Theoretical and Applied Informatics	PhD in Technical Sciences, 01.05.02-mathematical modeling and computational methods

When developing the Program project, the following requirements are taken into account::

1. Educational withtandarta higher education in the field of spezation 122 computer science areas of knowledge 12 Information technologies for the first (Bachelor's) level of higher education, approved by Order No. 962 of the Ministry of Education and Science of Ukraine dated 10.07.2019

1. Profile of the educational program

1-General information	
Full name of the institution of higher education and its structural division	V. N. Karazin Kharkiv National University Faculty of Mathematics and Computer Science
Official name of the program	Theoretical and applied Computer Science
Higher education degree	First (Bachelor's) level
Qualifications to be awarded	Bachelor of Computer Science, Theoretical and Applied Computer Science
Type of diploma and scope of the educational program	Bachelor's degree, single, 240 ECTS credits, the training period is 4 years
Availability of accreditation	Accreditation Commission. Ukraine. Certificate-SUN # 2189534 Validity period-01.07.2027.
Background	Complete general secondary education
Language of instruction	Ukrainian
Duration of the educational program	5 years
Internet address of permanent placement of the educational program description	https://sites.google.com/karazin.ua/tacs-ua/education
2 - purpose of the educational program	
Program goal	Training of specialists capable of performing projects in the field of computer science; applying mathematical methods and algorithmic principles in modeling, An, developing and maintaining information technologies; developing, implementing and maintaining intelligent systems for analyzing and processing data of organizational, technical, natural and socio-economic systems.
3-Characteristics of the educational program	
Subject area (field of knowledge, specialty, specialization (if available)**)**	12 Information technology, 122 computer science
Orientation of the educational program	Educational and professional activities, applied. Provides mastery of a set of general and professional competencies necessary for specialists to perform professional tasks and duties of an applied nature in the field of information technology. Professional accents – specialist in theoretical and applied computer science
Main focus of the educational program and specialization	Special education in the subject area that includes concepts and principles (higher and applied mathematics, programming, computer and mathematical modeling, intelligent data processing, system analysis and design, IT project management,

	enterprise architecture and IT infrastructure) how to ensure the acquisition of relevant competencies by the graduate. Keywords: programmer, computer science, mathematical models
App Features	Advanced mathematical training is essential for developing IT projects.
4-suitability of graduates for employment and further education	
Suitability for employment	Professional activity as a specialist in the development of mathematical, information and software for information systems, in the field of information technology, as well as an administrator of databases and systems. Graduates can work in professions according to the national classification of professions DC 003: 2010: 3121.2 information technology Specialist 3121.2 software development and testing specialist 3121.2 computer program development specialist
Further training	The possibility of studying under the second cycle program in this field of knowledge (which is consistent with the bachelor's degree obtained) or related-master's (educational and professional) programs of higher education.
5-teaching and evaluation	
Teaching and learning	The main approaches to learning are competence-based, student-centered, and problem-oriented. The leading teaching methods are problem-based, partially exploratory, and exploratory. Teaching and learning is conducted in the form of lectures, including interactive and multimedia lectures, practical classes, laboratory work, self-study, and course research. Project-based, educational-game, graphic educational modeling, and interactive-communicative learning technologies are used
Rating process	Four-level and two-level, 100-point assessment system through such types of control with the accumulation of points received: *current* (oral and written survey) control, intermediate (protection of practical, independent works), *final report* (written exams, test papers, defense of practice reports), self-monitoring, *certification process* (preparation and public defense of the bachelor's thesis)
6-program competencies	
Integral competence	The ability to solve complex specialized problems 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 complexity and uncertainty of conditions.
General competencies	GC01-ability to think abstractly, analyze and synthesize. GC02-ability to apply knowledge in practical situations. GC03-knowledge and understanding of the subject area and understanding of professional activity. GC04-ability to communicate in the state language both orally and in writing. GC05-ability to communicate in a foreign language.

	GC06-the ability to learn and master modern knowledge. GC07 - ability to search, process and analyze information from various sources. GC08-ability to generate new ideas (creativity). GC09-ability to work in a team. GC10-ability to be critical and self-critical. GC11-ability to make informed decisions. GC12-ability to evaluate and ensure the quality of work performed. GC13-ability to act on the basis of ethical considerations. GC14-the ability to exercise their rights and obligations as a member of society, to realize the values of a civil (free and democratic) society and the need for its sustainable development, the rule of law, human and civil rights and freedoms in Ukraine. GC15-the ability to preserve and increase moral, cultural, scientific values and achievements of society based on understanding the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, technology and technologies, to use various types and forms of motor activity for active recreation and healthy lifestyle.
Professional competencies	PC01-ability to mathematically formulate and study continuous and discrete mathematical models, substantiation of the choice of methods and approaches for solving theoretical and applied problems in the field of computer science, analysis and interpretation PC02 – ability to identify statistical patterns of non-deterministic phenomena, application of computational intelligence methods, in particular statistical, neural network and fuzzy data processing, machine learning methods training and genetic programming and the like. PC03-ability to think logically, draw logical conclusions, use formal languages and models of algorithmic calculations, design, develop and analyze algorithms, evaluate their effectiveness and complexity, solvability and unsolvability of algorithmic problems for adequate modeling of subject areas and creation of software and information systems. PC04-ability to use modern methods of mathematical modeling of objects, processes and phenomena, develop models and algorithms for numerical solutions mathematical modeling, take into account errors in the approximate numerical solution of professional problems. PC05-the ability to perform a formalized description of operations research tasks in organizational, technical and socio-economic systems for various purposes, determine their optimal solutions, build optimal management models taking into account changes in the economic situation, optimize management processes in systems for various purposes and hierarchy levels. PC06-ability to think systems, applying the methodology of system analysis to study complex problems of different nature,

	methods of formalization and solving system problems with conflicting goals, uncertainties and risks. PC07-the ability to apply theoretical and practical foundations of modeling methodology and technology to study the characteristics and behavior of complex objects and systems, to conduct computational experiments with processing and analysis of results. PC08-the ability to design and develop software using various programming paradigms: generalized, object-oriented, functional, logical, with appropriate models, methods and algorithms for computing, data structures and control mechanisms. PC09-the ability to implement a multi-level computing model based on the client-server architecture, including databases, knowledge and data warehouses, to perform distributed processing of large data sets on clusters of standard servers to meet the computing needs of users, including cloud services. PC10-the ability to apply methodologies, technologies and tools to manage the life cycle processes of information and software systems, information technology products and services in accordance with customer requirements. PC11-the ability to perform data mining based on computational intelligence methods, including large and poorly structured data, their operational processing and visualization of analysis results in the process of solving applied problems. PC12-the ability to organize computing processes in information systems for various purposes, taking into account the architecture, configuration, performance indicators of operating systems and system software. PC13-ability to develop network software that operates on the basis of various topologies of structured cabling systems, uses computer systems and data transmission networks, and analyzes the quality of computer networks. PC14-ability to apply methods and means of ensuring information security, develop and operate special software for protecting information resources of critical information infrastructure objects. PC15-ability to analyze and model functional business processes, build and apply functional models of organizational, economic, industrial and technical systems, and methods of risk assessment for their design. PC16-the ability to implement high-performance computing based on cloud services and technologies, parallel and distributed computing in the development and operation of distributed systems for parallel information processing. PC17-the ability to solve data analysis and processing problems using soft computing methods (neural networks, machine learning, genetic programming, etc.), based on an understanding of theoretical principles and knowledge of soft computing models, methods, and algorithms.

	PC18-ability to computer model geometric objects and their transformations based on vector and raster methods of computational geometry. PC19-ability to solve problems of reliable transmission of information over channels with interference, the use of algorithms for compression and recovery of information, evaluation of the main features of the system. information characteristics of digital communication channels.
7-program learning outcomes	
Programmatic learning outcomes	PLO01-apply knowledge of the basic forms and laws of abstract logical thinking, the basics of the methodology of scientific knowledge, forms and methods of extracting, analyzing, processing and synthesizing information in the subject area of computer science. PLO02-use the modern mathematical apparatus of continuous and discrete analysis, linear algebra, analytical geometry, in professional activities to solve problems of a theoretical and applied nature in the process of designing and implementing computerization objects. PLO03-use knowledge of the laws of random phenomena, their properties and operations on them, models of random processes and modern software environments to solve problems of statistical data processing and building predictive models. PLO04-use methods of computational intelligence, machine learning, neural network and fuzzy data processing, genetic and evolutionary programming to solve problems of recognition, prediction, classification, identification of control objects, and so on. PLO05-design, develop and analyze algorithms for solving computational and logical problems, evaluate the efficiency and complexity of algorithms based on the application of formal models of algorithms and calculated functions. PLO06-use methods of numerical differentiation and integration of functions, solutions of ordinary differential and integral equations, features of numerical methods and possibilities of their adaptation to engineering problems, have skills in software implementation of numerical methods. PLO07-understand the principles of modeling organizational and technical systems and operations; use methods of operations research, solving single-and multi-criteria optimization problems of linear, integer, nonlinear, and stochastic programming. PLO08-use the methodology of system analysis of objects, processes and systems for the tasks of analysis, forecasting, management and design of dynamic processes in macroeconomic, technical, technological and financial objects. PLO09-develop software models of subject environments, choose a programming paradigm from the point of view of convenience and quality of application for implementing methods and algorithms for solving problems in the field of computer science.

	PLO10-use tools for developing client-server applications, design conceptual, logical and physical database models, develop and optimize queries to them, create distributed databases, data warehouses and storefronts, knowledge bases, including on cloud services, using web programming languages. PLO11-possess the skills of managing the life cycle of software, information technology products and services in accordance with the requirements and limitations of the customer, be able to develop project documentation (feasibility study, technical task, business plan, agreement, Contract, contract). PLO12-apply methods and algorithms of computational intelligence and data mining in problems of classification, forecasting, cluster analysis, search for associative rules using software tools to support multidimensional data analysis based on modern technologies. PLO13-possess system programming languages and methods for developing programs that interact with computer system components, know network technologies, computer network architectures, have practical skills in computer network administration technology and their software PLO14-possess system programming languages and methods for developing programs that interact with computer system components, know network technologies, computer network architectures, have practical skills in computer network administration technology and their software PLO15-apply knowledge of methodology and CASE-tools for designing complex systems, methods of structural analysis of systems, object-oriented design methodology in the development and research of functional models of organizational, economic, industrial and technical systems. PLO16-understand the concept of information security, the principles of secure software design, and ensure the security of computer networks in conditions of incompleteness and uncertainty of source data. PLO17-perform parallel and distributed computing, apply numerical methods and algorithms for parallel structures, parallel programming language in the development and operation of parallel and distributed software. PLO18-be able to implement and apply basic methods and algorithms of soft computing for solving problems of data analysis and processing; have skills in working with modern special software frameworks for image processing, natural language, and building neural networks; prepare and normalize input data, including using regularization methods; evaluate the quality of models based on generally accepted metrics qualities. PLO19-know the mathematical basics of constructing vector and raster models of geometric objects, typical problems of computational geometry and methods for solving them, global problems of processing raster images; master the basic algorithms for solving problems of computational geometry and

	analysis of raster images; be able to use methods for constructing complex geometric objects from geometric primitives. PLO20-be able to build mathematical models of communication channels with various types of interference, know and be able to evaluate the information characteristics of such channels, understand the principles and know the methods of encoding and decoding in order to ensure reliable information transmission; evaluate the effectiveness of coding systems in specific conditions of their use.
8-resource support for program implementation	
Specific characteristics of human resources support	Complies with the license terms implementation of educational activities. All teachers are full-time university teachers, have a scientific degree and / or academic title corresponding to the main profile of the discipline taught. All teachers undergo advanced training once every five years.
Specific characteristics of logistics support	Equipment and equipment, technical training facilities (whiteboards, multimedia projectors, laptops, printers, scanners, personal computers with software) for the formation of subject competencies in the course of training of the applicant. There are classrooms, laboratories, computer labs, dormitories, food outlets, wireless Internet access points, gyms, and the like
Specific characteristics of information and educational support	Official website of the University, unlimited Internet access, printed materials (collections of the V. N. Karazin National Library, repository, own libraries of educational laboratories, cartographic works) and Internet sources (including e-learning Center of the University) information; training and work plans (with explanatory notes to them), educational programs, working programs of disciplines and practices, educational and methodological complexes of disciplines, including lecture material, practical work tasks, questions of seminars, tasks of independent work, questions, tasks, tasks for the current and final stage of the project. control system. Meets the license conditions, 100%
9-academic mobility	
National credit mobility	In accordance with the law
International credit mobility	Double degree programs: Erasmus + KA1 Academic Mobility Programs: Technical University of Lodz, Poland Nicolaus Copernicus University, Torun, Poland University of Murcia, Spain University of the Cote d'Azur, Nice, France
Training of foreign applicants for higher education	Citizens of other countries are accepted for training on the basis of international agreements on the conditions defined by these agreements, as well as agreements concluded by an educational institution with foreign educational institutions, organizations, or individual agreements or contracts.

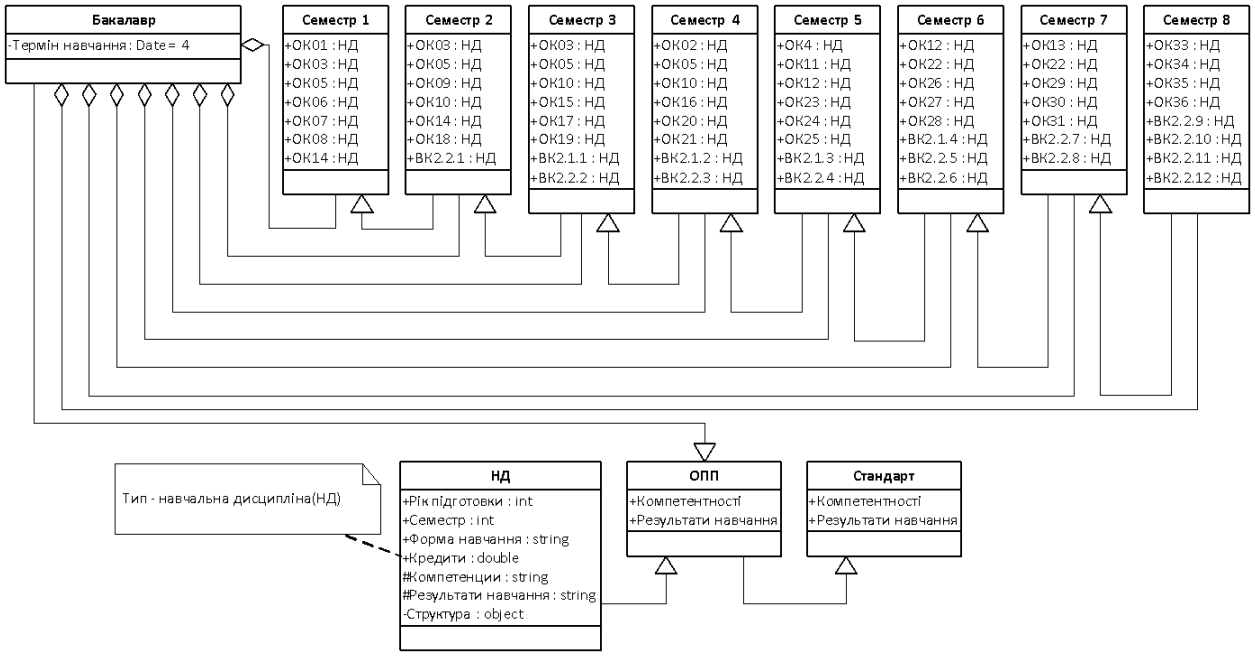
2. list of components of the educational and professional program and their logical sequence

2.1. list of OP components

N / A code	Components of the educational program (academic disciplines, course projects (works), internships, qualification work)	Quantity credits	Final control form
1	2	3	4
1. required OP components			
EC01	History of Ukraine	3	exam
EC02	Philosophy	3	exam
EC03	English language	10	exam /test
EC04	English by specialty	3	exam
EC05	Mathematical analysis	18	exam
EC06	Elements of algebra and number theory	6	exam
EC07	Elements of mathematical logic, elementary and discrete mathematics	4	test
EC08	Analytical geometry	4	test
EC09	Linear algebra	4	test
EC10	Discrete mathematics	12	exam
EC11	Differential equations	4	exam
EC12	Probability theory and its application	8	exam
EC13	Introduction to Mathematical statistics	4	exam
EC14	Programming	10	exam
EC15	Object-oriented Programming (c++)	4	exam
EC16	Object-oriented programming (Java language)	4	exam
EC17	Algorithms and data structures	4	exam
EC18	Computer system architecture	4	test
EC19	Operating systems	4	test
EC20	Mathematical logic and logic programming	4	test
EC21	Information networks	4	test
EC22	Optimization and research methods for operations	8	exam
EC23	Introduction to SQL Databases	4	exam
EC24	Web programming technologies	4	test
EC25	Declarative Programming (functional languages)	4	test
EC26	Theory and methods of relational database design	4	exam
EC27	User interface development methods	3	exam
EC28	Introduction to Parallel Process Programming (C++ and Java)	4	exam
EC29	Development of compilers for domain-specific languages	3	test
EC30	Design of software systems	4	exam
EC31	Parallel and distributed computing	4	exam
EC32	Course research work	3	test
EC33	Introduction to Artificial Intelligence	4	exam
EC34	Technical English	3	test
EC35	Research practice	5	test
EC36	Preparation of the qualification work	2	protection
Total amount of required components		**180**	
2. selected OP components			
	2.1. General training cycle		

N / A code	Components of the educational program (academic disciplines, course projects (works), internships, qualification work)	Quantity credits	Final control form
1	2	3	4
	4 disciplines are selected according to the university's inter-faculty catalog (at least out of 200) with a total volume of 12 ECTS		
SC 2.1.1	Inter-faculty selective discipline	3	test
SC 2.1.2	Inter-faculty selective discipline	3	test
SC 2.1.3	Inter-faculty selective discipline	3	test
SC 2.1.4	Inter-faculty selective discipline	3	test
	2.2 Cycle of professional (professional) training		
	(12 disciplines are selected according to the catalog of professional selective disciplines of the faculty with a total volume of 48 ECTS) https://sites.google.com/karazin.ua/tacs-ua/education/syllabus-bachelor?#h.sdzp92xwoh85		
SC 2.2.1	Discipline P-1	4	test
SC 2.2.2	Discipline P-2	4	test
SC 2.2.3	Discipline P-3	4	test
SC 2.2.4	Discipline P-4	4	test
SC 2.2.5	Discipline P-5	4	test
SC 2.2.6	Discipline P-6	4	test
SC 2.2.7	Discipline P-7	4	test
SC 2.2.8	Discipline P-8	4	test
SC 2.2.9	Discipline P-9	4	test
SC 2.2.10	Discipline P-10	4	test
SC 2.2.11	Discipline P-11	4	test
SC 2.2.12	Discipline P-12	4	test
Total volume of sample components		**60**	
TOTAL SCOPE OF THE EDUCATIONAL PROGRAM		**240**	

2.2. Structural and logical scheme of the OP



3. Form of certification of applicants for higher education

Certification of applicants for higher education in the specialty is carried out in the form of a public defense (demonstration) of the qualification work.

Requirements for the qualification work:

The qualification work should include theoretical, system engineering or experimental research of a complex specialized task or practical problem in the field of computer science, which is characterized by complexity and uncertainty of conditions and requires the application of information technology theories and methods.

There should be no academic plagiarism, falsification or fabrication in the qualification work.

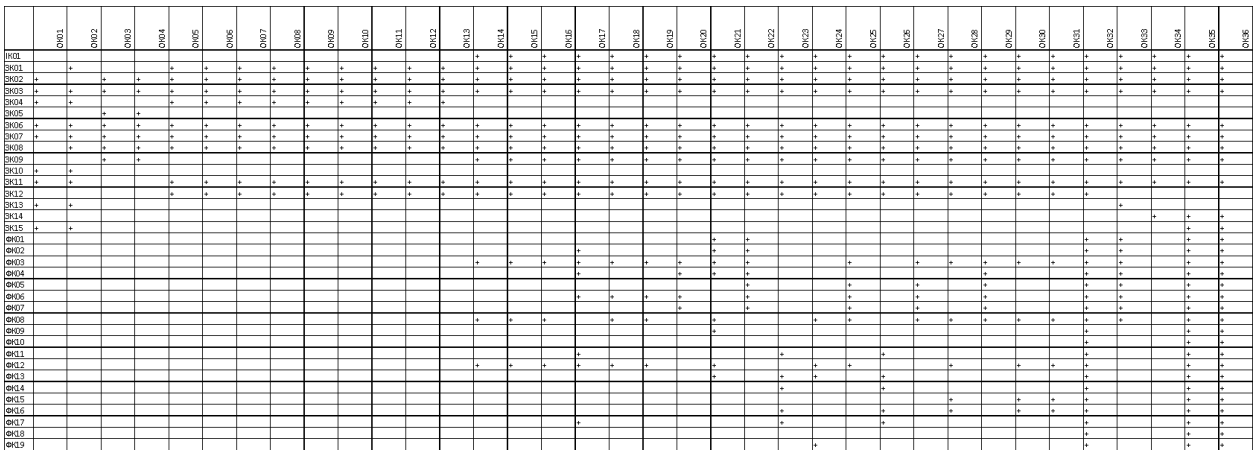
The qualification work must be published on the official website of the higher education institution or its structural division, or in the repository of the higher education institution.

Public defense (demonstration) of a qualifying work provides for::

- presentation of the main provisions of the work in the form of a multimedia presentation and an explanatory note;
- preliminary announcement on the official website of the higher education institution;
- open form of the commission meeting;
- announcement on the same day after the end of the defense of the assessment of the qualification work and registration of the minutes of the commission meeting;
- adoption by the commission of a decision on awarding the qualification bachelor of information systems and technologies, information technologies of data analysis and issuing a bachelor's degree based on the results of the final certification of students.

Certification is carried out openly and publicly before the examination committee, which is approved by the order of the Rector of V. N. Karazin Kharkiv National University. The applicant's report must be accompanied by a presentation using multimedia technology in order to be convincing and confirm the conclusions and suggestions.

4. Matrix of correspondence of program competencies to the components of the educational program



5. Matrix of providing program-based learning outcomes (PRS) with relevant components of the educational program

	ОК01	ОК02	ОК03	ОК04	ОК05	ОК06	ОК07	ОК08	ОК09	ОК10	ОК11	ОК12	ОК13	ОК14	ОК15	ОК16	ОК17	ОК18	ОК19	ОК20	ОК21	ОК22	ОК23	ОК24	ОК25	ОК26	ОК27	ОК28	ОК29	ОК30	ОК31	ОК32	ОК33	ОК34	ОК35	ОК36
ПРН01	+		+		+		+		+		+		+				+		+	+		+									+			+		+
ПРН02					+		+		+		+		+				+		+	+		+	+			+			+		+			+	+
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