

ALIKHAN BOKEIKHAN UNIVERSITY

MODULAR EDUCATIONAL PROGRAM
8D06110-«INFORMATICS»

Semey, 2022

Developed by the Department of "Information and Technical Sciences"

Discussed and approved at the meeting of the Department of "Information and Technical Sciences"
(Protocol No. 9 of 05.05.22).

Reviewed and recommended for approval at the meeting
Academic Quality Council of the Faculty
(protocol No. 7 of 18.05.22).

Reviewed and approved at the meeting of the Educational and Methodological Council of the University
(Protocol No. 5 of 25.05.22).

Revised and recommended for re - approval at a meeting Academic Quality Council of the Faculty
(protocol No. 1 of 16.09.22)

Revised and re-approved at the meeting of the Educational and Methodological Council of the University
(protocol No. 1 of 22.09.22)

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1. Explanatory note

The modular educational program (MEp) is compiled in accordance with:

- The State standard of higher and Postgraduate education, approved by the Order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022 No. 2;
- Rules for the organization of the educational process on credit technology of education, approved by Order No. 152 of the Minister of Education and Science of the Republic of Kazakhstan dated April 20, 2011;
- Standard Rules for the activities of organizations of Higher and (or) Postgraduate Education, approved by Order No. 595 of the Minister of Education and Science of the Republic of Kazakhstan dated October 30, 2018;
- Professional standard "Teacher", appendix to Order No. 133 of June 8, 2017
- The structure of the modular educational program was approved by the Academic Council of the University (Revision No. 4 of 05.10.2022 instead of revision No. 3 of 08.10.2021 (normative documents of the educational institution "Alikhan Bokeikhan University").

The MOS is designed as a set of sequential training modules for the entire period of study and is aimed at mastering the competencies necessary for awarding the academic degree of Doctor of Philosophy PhD in the educational program 8D06110 "Informatics".

The block of basic disciplines (BD) consists of 25 credits, of which the disciplines of the university component (UC) -10 credits, pedagogical practice – 10 credits, the elective component (EC) -5). Modules of these disciplines form a complex of general professional competencies: key competencies and scientific and pedagogical competencies

The block of profile disciplines (PD) consists of 20 credits, of which the disciplines of the university component (UC) - 5 credits, research practice, which makes up 10 credits, the component of choice – 5 credits. Modules of these disciplines allow you to form a special set of competencies acquired by a graduate of special professional and research competencies.

Research work of a doctoral student including the completion of a doctoral dissertation 123 credits and Final Certification -12 credits. Total for OP – 180 credits. The MEP consists of 4 modules. The training period is 3 years.

The purpose of the PhD educational program is to train highly qualified and competent personnel in the field of computer science and informatization of education, who possess modern analytical and information technologies, are able to carry out scientific and professional activities at a high level, and are competitive in the labor market.

List of learning outcomes with codes for the educational program 8D06110 "Informatics"

ON1: to form a scientific style of speech and writing, to identify and correlate their own scientific interests with social and ethical values in the educational process and research.

ON2: conduct experimental and analytical activities in scientific research in the field of computer science and predict the results of scientific research; generate new ideas in solving research and practical problems, including in interdisciplinary fields, expanding the boundaries of scientific knowledge.

ON3: apply modern programming languages, methods of analysis and research of algorithms, various software development technologies in their professional activities.

ON4: analyze risk assessment in information security management, choose the ability to autonomous and scientific analysis and synthesis, as well as to review and evaluate new and complex phenomena, problems and situations.

ON5: to use new knowledge and skills in practical activities and compare different theoretical concepts in the field of research and draw conclusions.

ON6: conduct independent scientific research characterized by academic integrity, based on modern theories and methods of analysis, and plan and predict the results of the study.

In order to create special conditions for people with special educational needs to receive education, the graduate's competence model is supplemented with professional competencies that ensure the adaptive nature of the main educational program. To this end, courses for the formation of the ability of persons with special educational needs to successfully socialize in society and actively adapt to the labor market, taking into account the characteristics of the disease, are introduced into the catalog of courses of the additional educational program "Minor".

1. The graduate's competence model

1 Competence of general education

Doctor of Philosophy (PhD) in the educational program 8D06110 - Computer Science must meet the following requirements:

have an idea of:

- the main stages of development and paradigm shift in the evolution of science;
- about scientific schools of the relevant branch of knowledge, their theoretical and practical developments;

know and understand:

- current trends, trends and patterns of development of Russian science in the context of globalization and internationalization;

be able to:

- to organize, plan and implement the process of scientific research;

have skills:

- conducting patent search and experience in the transfer of scientific information using modern information and innovative technologies;
- free communication in a foreign language;

be competent:

- in the field of scientific and scientific-pedagogical activity in the conditions of rapid updating and growth of information flows;
- in carrying out theoretical and experimental scientific research;
- to conduct a professional and comprehensive analysis of problems in the relevant field;

2 Scientific and pedagogical competencies

The Doctor of Philosophy (PhD) in the educational program 8D06110 - Computer Science must meet the following requirements:

have an idea:

- about scientific concepts of world and Kazakh science in the relevant field;
- on the mechanism of implementation of scientific developments in practical activities;
- about the pedagogical and scientific ethics of a research scientist;

be able to:

- generate your own new scientific ideas, communicate your knowledge and ideas to the scientific community, expanding the boundaries of scientific knowledge;

have skills:

- critical analysis, evaluation and comparison of various scientific theories and ideas;
- responsible and creative attitude to scientific and scientific-pedagogical activity;

3 Competencies solving scientific problems

Doctor of Philosophy (PhD) in the educational program 8D06110 - Computer Science:

have an idea:

- on the subject, ideological and methodological specifics of the natural (social, humanitarian, economic) sciences;
- on the norms of interaction in the scientific community;

know and understand:

- methodology of scientific knowledge;

be able to:

- analyze, evaluate and compare various theoretical concepts in the field of research and draw conclusions;
- analyze and process information from various sources;

have skills:

- analytical and experimental scientific activities;
- scientific writing and scientific communication;
- planning, coordination and implementation of scientific research processes;
- participation in scientific events, fundamental scientific domestic and international projects;
- protection of intellectual property rights to scientific discoveries and developments;

be competent:

- in carrying out the expertise of scientific projects and research;

4 Socio-economic competencies

Doctor of Philosophy (PhD) in the educational program 8D06110 - Computer Science:

to know and understand:

- (to realize and accept) the social responsibility of science and education;

be able to:

- to choose and effectively use modern research methodology;

be competent:

- in matters of interpersonal communication and human resource management;

5 System-forming competencies:

Doctor of Philosophy (PhD) in the educational program 8D06110 - Computer Science:

to know and understand:

- perfect foreign language for scientific communication and international cooperation;

be able to:

- conduct independent scientific research, characterized by academic integrity, based on modern theories and methods of analysis;

have leadership management and team management skills;

6 Professional and activity competence

Doctor of Philosophy (PhD) in the educational program 8D06110 - Computer Science:

to know and understand:

- achievements of world and Kazakh science in the relevant field;

be able to:

- plan and predict your further professional development;

have skills:

- planning and forecasting of research results;
- public speaking and public speaking at international scientific forums, conferences and seminars;
- a systematic understanding of the field of study and demonstrate the quality and effectiveness of the selected scientific methods;

be competent:

- in the formulation and solution of theoretical and applied problems in scientific research;
- in matters of university training of specialists;
- in ensuring continuous professional growth.

Table 1. The sequence of mastering disciplines in the process of forming special competencies

№	Competencies	The list of compulsory, elective disciplines and the sequence of their study		Expected results
		List of disciplines	The sequence of their study	
1	Professional, scientific and pedagogical, research, project planning and management, organizational and managerial competencies	Research and analysis of algorithms	1 semester	<p>to know: methods of algorithm analysis in iterative implementation; methods of algorithm analysis in recursive implementation; decomposition method and dynamic programming method as methods of developing effective algorithms.</p> <p>be able to: evaluate computer algorithms using complex quality criteria, including evaluating the resource efficiency of algorithms; plan an experiment, conduct an experimental study of algorithms; apply methods of mathematical analysis and modeling, theoretical and experimental research; use appropriate mathematical apparatus and tools for processing, analyzing and systematizing information on the research topic;</p> <p>possess: tools for measuring time in software implementations of algorithms; methods and means for assessing the complexity of algorithms in their iterative and recursive implementation; methods for developing effective algorithms based on their comparative analysis; basic methods, methods and means of obtaining, storing, processing information.</p>
3	Professional, scientific problem solving, research, project planning and management	Scientometrics	1 semester	<p>To know: basic concepts: scientometry, scientific citation index, Hirsch index, impact factor, etc.; the main international and Russian scientometric databases; requirements for registration of the results of scientific activity for entering them into databases.</p> <p>Be able to: determine the scientific citation index and the impact factor of journals; find and analyze information about their publications and publications on the topic of their research; navigate scientometric databases and use built-in tools. Possess:</p>

				skills of working with scientometric databases; methods of searching for scientific information in electronic catalogs, databases and the Internet; scientometric methods of analyzing publication activity; presentation of the main methods of evaluating scientific activity
4	Professional and activity competence, Competence to solve scientific problems	Methods of data mining	1 semester	<p>know: the main tasks and methods of data mining; has a culture of thinking, is capable of generalization, analysis, perception of information, setting goals and choosing ways to achieve it;</p> <p>be able to: formulate data analysis tasks, choose adequate algorithms for their solution, evaluate the quality of the solutions obtained.</p> <p>possess: skills in the process of professional activity to identify emerging data analysis problems, is able to formalize them and identify the most appropriate methods of solving them.</p>
		Modern concept of building systems	1 semester	<p>to know: fundamentals of information systems; formal models of systems; models of subject areas of information systems; methods of analysis and synthesis of information systems; business process models; object-oriented approach; analysis of information systems structures; mechanisms of system integration. be able to: develop models of subject areas; conduct research on the characteristics of components and information systems in general; apply methods and tools for designing information systems in practice; evaluate the quality of the information systems project; to monitor the development of project documentation.</p> <p>possess the skills of: analysis of information systems; development of mathematical models of information systems; formation and design of specifications of requirements in terms of flexible programming technologies.</p> <p>be competent - in organizing and conducting the analysis and synthesis of information systems.</p>
5	Professional, scientific and pedagogical, research, project planning and management,	Academic writing	2 semester	Russian Russian language lexical, morphological, grammatical and syntactic norms; functional styles of Russian and English languages; the main provisions of the theory of communication,

	organizational and managerial competencies			<p>language and text; the basic system of terminology in the field of training;</p> <p>be able to: work with information in global computer networks; compose integral and coherent texts of various stylistic affiliation in Russian;</p> <p>possess: fully stylistic features of the Russian language; culture of thinking; ability to perceive, analyze, summarize information, set goals and choose ways to achieve it; basic methods, methods and means of obtaining, storing, processing information, computer skills as a means of information management.</p>
		Methods of scientific research	2 semester	<p>to know: the main sources and methods of scientific information search, the main range of problems (tasks) encountered in the economy, the main ways (methods, algorithms) of solving problems (tasks) encountered in the economy</p> <p>be able to: analyze, systematize and assimilate the best practices of conducting scientific research in the professional field, collect, select and use the necessary data and effectively apply quantitative methods of them, identify and justify the author's contribution to the research, evaluate its scientific novelty and practical significance, provided that the contribution and achievements of other researchers involved in this issue are respected</p> <p>possess: modern methods, tools and technology of research and project activities in certain areas of economic science, the skills to find the most effective methods of solving the main types of problems (tasks) encountered in professional activity, the skills to publish the results of scientific research, including those obtained personally by students, in domestic and foreign peer-reviewed scientific publications</p>
7	Professional, scientific and pedagogical, research, project planning and management	Risk analysis and assessment in information security management	2 semester	<p>to know: modern approaches to information security management and directions of their development; basic standards governing information security management; principles of building ISMS; principles of developing information security management processes; to be able to: analyze the current state of</p>

				information security at the enterprise in order to develop requirements for the developed information security management processes; to determine the goals and objectives solved by the developed information security management processes; to apply process approach to information security management in various fields of activity; possess: information security management skills of simple objects
		Parallel programming in CUDA	2 semester	to know: the use of a video card for non-graphical computing in scientific work; to be able to: create parallel programs for computing systems with distributed, shared RAM; to parallelize computational algorithms; to possess skills: in constructing parallel analogs of computational algorithms; to be competent: in formulating the main problems of the subject area, to apply universal methods and tools for their solution; the ability to develop algorithms, computational models and data models to implement the functionality of information systems and software.

Table 2. Sequence of mastering disciplines of social and professional interaction

Course	Providing disciplines	Competencies	Expected results
Basic disciplines University components			
1	Research and analysis of algorithms	Professional, scientific and pedagogical, research, project planning and management, organizational and managerial competencies	<p>to know: methods of algorithm analysis in iterative implementation; methods of algorithm analysis in recursive implementation; decomposition method and dynamic programming method as methods of developing effective algorithms.</p> <p>be able to: evaluate computer algorithms using complex quality criteria, including evaluating the resource efficiency of algorithms; plan an experiment, conduct an experimental study of algorithms; apply methods of mathematical analysis and modeling, theoretical and experimental research; use appropriate mathematical apparatus and tools for processing, analyzing and systematizing information on the research topic;</p> <p>possess: tools for measuring time in software implementations of algorithms; methods and means for assessing the complexity of algorithms in their iterative and recursive implementation; methods for developing effective algorithms based on their comparative analysis; basic methods, methods and means of obtaining, storing, processing information.</p>
1	Pedagogical practice	Scientific and pedagogical competencies	<p>to know: the pedagogy of higher education, the structure and regulatory documentation of the institution of vocational education; to be guided in the theoretical foundations of the science of the taught subject; the features of the educational process at the university.</p> <p>be able to didactically transform the results of modern scientific research in order to use them in the educational process; independently design, implement, evaluate and adjust the educational process; use modern innovations in the process of vocational training;</p> <p>skills: to master the methods of self-organization of activity and</p>

			improvement of the teacher's personality; to build relationships with colleagues, to find, to possess the skills of practical use of knowledge of the basics of pedagogical activity in teaching a history course, to make and implement managerial decisions in their scientific and pedagogical practice; to master conducting various types of classes with students in the academic discipline assigned to him; to master the culture of
1	Academic writing	Professional, scientific and pedagogical, research, project planning and management, organizational and managerial competencies	Russian language lexical, morphological, grammatical and syntactic norms; functional styles of Russian and English languages; the main provisions of the theory of communication, language and text; the basic system of terminology in the field of training; be able to: work with information in global computer networks; compose integral and coherent texts of various stylistic affiliation in Russian; possess: fully stylistic features of the Russian language; culture of thinking; ability to perceive, analyze, summarize information, set goals and choose ways to achieve it; basic methods, methods and means of obtaining, storing, processing information, computer skills as a means of information management.
1	Methods of scientific research	Professional, scientific and pedagogical, research, project planning and management, organizational and managerial competencies	to know: the main sources and methods of scientific information search, the main range of problems (tasks) encountered in the economy, the main ways (methods, algorithms) of solving problems (tasks) encountered in the economy be able to: analyze, systematize and assimilate the best practices of conducting scientific research in the professional field, collect, select and use the necessary data and effectively apply quantitative methods of them, identify and justify the author's contribution to the research, evaluate its scientific novelty and practical significance, provided that the contribution and achievements of other researchers involved in this issue are respected possess: modern methods, tools and technology of research and project activities in certain areas of economic science, the skills to find the most effective methods of solving the main types of

			problems (tasks) encountered in professional activity, the skills to publish the results of scientific research, including those obtained personally by students, in domestic and foreign peer-reviewed scientific publications
Components of choice			
1	Methods of data mining/Modern concept of building systems	Professional activity, research and scientific and pedagogical competencies	<p>to know: fundamentals of the methodology of scientific research (methodology of science, methodology of scientific activity) as a teaching about the organization of scientific activity; methods and methods of modern scientific knowledge in the professional field; methods of designing, organizing, evaluating and correcting experimental and research activities at various stages; be able to: identify promising areas of scientific research in the subject area of professional activity, the composition of research papers, their determining factors; possess: terminology of scientific research; modern methods of scientific research in the subject area; skills of hypothesis formulation, selection of necessary research methods; skills of collection, processing</p> <p>to know: fundamentals of information systems; formal models of systems; models of subject areas of information systems; methods of analysis and synthesis of information systems; business process models; object-oriented approach; analysis of information systems structures; mechanisms of system integration. be able to: develop models of subject areas; conduct research on the characteristics of components and information systems in general; apply methods and tools for designing information systems in practice; evaluate the quality of the information systems project; to monitor the development of project documentation.</p> <p>possess the skills of: analysis of information systems; development of mathematical models of information systems; formation and design of specifications of requirements in the context of flexible programming technologies; be competent - in the organization and conduct of analysis and synthesis of information systems.</p>
Profile disciplines University components			

1	Scientometrics	Professional, scientific problem solving, research, project planning and management	To know: basic concepts: scientometry, scientific citation index, Hirsch index, impact factor, etc.; the main international and Russian scientometric databases; requirements for registration of the results of scientific activity for entering them into databases. Be able to: determine the scientific citation index and the impact factor of journals; find and analyze information about their publications and publications on the topic of their research; navigate scientometric databases and use built-in tools. Possess: skills of working with scientometric databases; methods of searching for scientific information in electronic catalogs, databases and the Internet; scientometric methods of analyzing publication activity; presentation of the main methods of evaluating scientific activity
2	Research practice	Research competencies	to know: in-depth theoretical and practical knowledge of professional activity; to acquire and use in practice new knowledge and skills, the ability to use the idea of the methodological foundations of scientific knowledge, the role of scientific information in the development of science; be able to: conduct bibliographic work with the involvement of modern information technologies, analyze scientific information; classify the main universal concepts used in the methodology of historical science, the main directions of modern theoretical and methodological research, analyze the scientific essence of problems arising in the course of professional activity; the ability and willingness to apply modern research methods, conduct scientific research, evaluate the results of the work performed; skills: to use modern achievements of historical science and advanced technology in research; to plan and set research objectives, to choose methods of IP
Components of choice			
1	Risk analysis and assessment in information security management/ Parallel programming in CUDA	Professional, scientific and pedagogical, research, project planning and management	to know: modern approaches to information security management and directions of their development; basic standards governing information security management; principles of building ISMS; principles of developing information security management processes; to be able to: analyze the current state of information

			<p>security at the enterprise in order to develop requirements for the developed information security management processes; to determine the goals and objectives solved by the developed information security management processes; to apply process approach to information security management in various fields of activity; possess: information security management skills of simple objects</p> <p>to know: the use of a video card for non-graphical computing in scientific work; to be able to: create parallel programs for computing systems with distributed, shared RAM; to parallelize computational algorithms; to possess skills: in constructing parallel analogs of computational algorithms; to be competent: in formulating the main problems of the subject area, to apply universal methods and tools for their solution; the ability to develop algorithms, computational models and data models to implement the functionality of information systems and software.</p>
Research work(RW)			
1,2,3 ,4,5, 6	Research work of doctoral students, including internship and doctoral dissertation (SRWD)	Research competencies	<p>to know: a systematic understanding of the field of study, various theoretical concepts in the field of research and draw conclusions; new scientific ideas, communicate their knowledge and ideas to the scientific community, expanding the boundaries of scientific knowledge;</p> <p>be able to: organize, plan and implement the process of scientific research; analyze, conduct independent scientific research, adapt modern theoretical and methodological concepts to solve a specific scientific and historical problem, interpret and explain the main theoretical and methodological schools and trends, models characterized by academic integrity, based on modern theories and methods of analysis; choose and effectively use modern research methodology;</p> <p>skills: possess the basic skills of planning, forecasting, coordinating and implementing the processes of research work on the topic of a dissertation, scientific internship, comprehend and evaluate the latest achievements of historical science, preparation of scientific</p>

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The list of modules included in the educational program

Module No.	Name of the module	Name of disciplines	Block	Term	The volume of credits for the discipline	Form of control	Total credits by module
M.1	Algorithm research	The study and analysis of algorithms	UC BD	1	5	Exam	5
M.2	Practice	Pedagogical practice	UC BD	1	10	Report	10
M.3	Academic writing	Academic writing	UC BD	2	3	Exam	3
M.4	Scientific research	Methods of scientific research	UC BD	2	2	Exam	2
M.3	Data mining and neural networks	Methods of data mining/	UC CC	1	5	Exam	10
		Modern concept of building systems	UC CC	1	5	Exam	
M.5	Languages and data processing technology	Scientometrics	UC MD	1	5	Exam	5
M.6	Practice	Research practice	UC CC	3	10	Report	10
M.4	Information security	Risk analysis and assessment in information security management	UC CC	2	5	Exam	10
		Parallel programming in CUDA	UC CC	2	5		
M.7	Research work	Research work of doctoral students, including internships and doctoral dissertation (R&D)	НИРД	1,2,3,4, 5,6	123	diff/c	123
M.8	Final state certification	Preparation of a doctoral dissertation	ИА		10		12
		Defense of the master's thesis	ИА	6	2	Protection	
	Total				190		190