

Kazakh Humanitarian-Juridical Innovative University

**MODULAR EDUCATIONAL PROGRAM
8D06110-«INFORMATICS»**

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Developed by the Department of Information Technology Sciences

Discussed and approved at the meeting of the Department of Information Technology Sciences

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1. Explanatory note

The modular educational program (MOE) was compiled in accordance with the regulation "Rules for the organization of the educational process on credit technology of education" No. 152 dated April 20, 2011, SES RK dated August 23, 2012 No. 1080 of Appendix No. 248, standard curriculum of specialty 6D060200-Informatics dated May 3, 2016 No. 292 (Appendix 258); Professional standard "Teacher", approved by Order No. 133 of the Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken" dated June 8, 2017; the structure of the modular educational program (Form 26, revision No. 1 of 17.01.2014)

of the MOS is designed as a set of consecutive 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 – Computer Science.

Scope of application: implements the tasks of the content of the educational program for the training of scientific and pedagogical personnel for the system of postgraduate education and the scientific sphere according to the educational program 8D06110 - Informatics.

Areas of professional activity:

- research and experimental research activities in research institutes, research centers, design and research organizations as a senior researcher, head of a research group, software engineer, information security engineer;
- scientific and pedagogical activity in institutions of higher, postgraduate education and the research sector as a teacher, senior researcher;
- organizational and managerial activities in public administration bodies, in the service sector, administrative management, in business structures as an information security administrator, head of the project management department, information security engineer, expert analyst;
- design and engineering activities at industrial enterprises, in design organizations, as well as organizations engaged in research and the introduction of new scientific achievements in the field of computer science and computer technology as the head of the research and development department, developer and analyst of software and applications, software engineer.

The objects of professional activity of doctoral graduates are research centers, design and scientific production organizations, management bodies, educational institutions, industrial enterprises and other organizations of various forms of ownership that use mathematical methods and computer technologies in their activities.

Functions of professional activity

-research and solve scientific and professional tasks based on knowledge of global trends in the development of computer science;

- to take direct part in the academic work of departments and other educational units of computer science;

- organization and management of work by teams of scientific researchers or developers of hardware and/or software of information and automated systems and further operation.

Types of professional activity Research and research, design and engineering, production and technological, educational

List of specialist positions researcher, teacher and researcher in higher educational institutions

The objects of professional activity:

- research and scientific-survey;

- design and engineering;

- innovative;

- educational.

The Doctor of Philosophy (PhD) in the educational program 8D06110 - Computer Science must be competent in professional activity, in scientific and pedagogical activity, in solving scientific problems, in professional communication and intercultural communication, be ready for personal and professional growth.

In the doctoral program of the scientific and pedagogical direction, the volume of disciplines of the DB cycle (basic disciplines) is 25 credits in total, the university component is 10, the elective component is 15 credits. As a result of studying the disciplines of the DB cycle, the student should know the main sections of Research and analysis of algorithms necessary for studying professional disciplines.

The cycle of PD (profile disciplines) - a total of 28 credits, the university component - 18, the component of choice - 10 credits.

The educational program of scientific and pedagogical doctoral studies includes two types of practices:

- pedagogical - 5 credits - in the organization of education;

- research - 8 credits - at the place of the dissertation.

Pedagogical practice is conducted in order to form practical skills and teaching methods.

The research practice of the undergraduate is conducted in order to familiarize himself with the latest theoretical, methodological and technological achievements of domestic and foreign science, with modern methods of scientific research, processing and interpretation of experimental data.

All types of practices are implemented in accordance with the individual curriculum in terms determined by the academic calendar and the individual work plan of the doctoral student. The individual work plan of a doctoral student provides for the mandatory passage of a foreign scientific internship.

Research work in the scientific and pedagogical direction of doctoral studies should:

- correspond to the main problems of the specialty in which the doctoral dissertation is being defended;
- be relevant, contain scientific novelty and practical significance;
- be based on modern theoretical, methodological and technological achievements of science and practice;
- based on modern methods of data processing and interpretation using computer technology;
- be carried out using modern methods of scientific research;

- contain research (methodological, practical) sections on the main protected provisions.

The results of the research work at the end of each period of their passage are issued by the doctoral student in the form of a report.

The final result of the master's research work is a doctoral dissertation.

In the conditions of the process of informatization of society, specialists in the field of computer technology are in demand, having a high level of professional competence in the field of development and operation of system software for computer equipment and automated systems. Software development methods and tools allow the use of software tools in planning, project management and project execution control using practical methods of effective management.

The purpose of the educational program is to train highly qualified, competitive PhD doctors with deep theoretical and practical knowledge in the field of computer science, able to set and solve new scientific problems and lead scientific research and innovative projects.

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. Sequence of mastering disciplines of social and professional interaction

№	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 semestr	<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>
2	Professional, research, project planning and management	Knowledge representation languages	1 semestr	<p>to know: basic definitions and concepts of the course, means of recording operators, working with graphics, working with forms and menus; techniques and methods of creating forms using the Java programming language</p> <p>Be able to: develop task programs in Java, write them and execute them on a computer. to determine the purpose and task of creating small projects; to determine the advantages and disadvantages of well-known programming languages and</p>

				<p>methods of their improvement; the use of classes and class variables as the main structural units of programs;</p> <p>влад own: methods of developing programs for various computational processes; declaration of variables and methods, their use in a program in a programming language.</p>
3	Professional, scientific problem solving, research, project planning and management	Scientometrics	1 semestr	
4	Professional and activity competence, Competence to solve scientific problems	Methods of data mining	1 semestr	<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 semestr	<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 system structures; mechanisms of system integration.</p> <p>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 conditions of flexible programming technologies.</p>

				be competent - in organizing and conducting the analysis and synthesis of information systems.
5	Professional, project planning and management, organizational and managerial competencies	Neural networks	2 semestr	to know: modern models of artificial neural networks, methods of their application for information processing and pattern recognition: models of artificial neural networks; methods of application of neural network models for information processing and pattern recognition; be able to: set tasks and develop algorithms for solving them for the implementation of software implementations of neural networks for the purpose of processing static and video images: apply various models of neural networks in solving information processing problems; develop software implementations of neural networks for the purpose of processing static and video images; possess: skills in setting and solving problems using various neural network models, give skills in setting and solving various types of problems using neural networks; teach the choice of adequate neural network models and algorithms.
		Neural computing and its applications	2 semestr	to know: the basic principles of the organization of information processes in neurocomputer systems; the main architectures of neurocomputer systems and their applications; the main methods and rules of training of neuro-computer systems; to have the skills to develop and implement software models of neurocomputer systems; to be able to make assessments and compare the quality of training and functioning of various models of neurocomputer systems.
6	Professional, project planning and management, organizational and managerial competencies	Reliability and security in cloud computing	2 semestr	know: technical and software tools required for the implementation of cloud technologies; modern methods for the protection of cloud technologies; the essence of innovative cloud computing tools; be able to: choose modern electronic equipment for the implementation of cloud technologies; design information systems using innovative tools; possess: skills in the operation of modern electronic equipment used for the security of cloud technologies.

		Computer-integrated technologies in electronics	2 semestr	to know: basic information structures used in mathematical modeling (variables, arrays, vectors, matrices, classes), methods of creation, import/export and operations with these structures; mathematical models most often used in scientific research (algebraic and transcendental systems of equations, ODE, UMF, filtering, optimization); standards for the presentation and storage of experimental data, methods of their export/import and processing; be able to: solve practical problems of scientific research with the help of modern end-user tools, find and master new general and specialized software tools; possess the skills: modern information and information and communication technologies and tools for solving general scientific problems in their professional field and for the organization of work; be competent - in conducting scientific research using computer technology.
7	Professional, scientific and pedagogical, research, project planning and management	Risk analysis and assessment in information security management	2 semestr	to know: modern approaches to information security management and the 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 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 a process approach to information security management in various fields of activity; to possess: information security management skills of simple objects
		Parallel programming in CUDA	2 semestr	know: the use of a video card for non-graphical computing in scientific work; be able to: create parallel programs for computing systems with distributed, shared RAM; parallelize computational algorithms; possess skills: in constructing parallel analogs of computational algorithms; be competent: in formulating the main problems of the subject area, apply universal methods and tools for their solutions; the ability to

				develop algorithms, computational models and data models to implement the functionality of information systems and software.
8		Foreign consultant's course "IT Services and Content Management"	2 semestr	know: types of content of information resources of the enterprise and Internet resources, the processes of managing the life cycle of digital content, the processes of creating and using information services (content services); be able to: manage the processes of the life cycle of enterprise content and Internet resources, manage the processes of creating and using information services (content services; own - methods of managing the processes of the life cycle of enterprise content and Internet resources, methods of managing the processes of creating and using information services (content services), methods of designing, developing and implementing technical solutions in the field of creating content management systems of Internet resources and content management systems of the enterprise
		Theory of digital signal processing and Pattern Recognition	2 semestr	to know: scientific foundations and methods of working with digital information processing; modern methods of digital information processing at the informatization facility based on domestic and international standards; methods and means of digital processing of informatization; the role and tasks of methods and means for pattern recognition in modern information management and information computing systems for various purposes; modern approaches to the construction of image recognition systems; be able to: select and analyze indicators and quality criteria for individual image recognition methods and image recognition systems in general; use modern scientific and technical information on the studied problems and tasks of image recognition; apply the knowledge gained when performing qualification work, as well as in the course of scientific research; possess the skills of: analysis and objective quantitative assessment of the effectiveness of certain methods and algorithms of image recognition; formal formulation and solution of the problem of building image recognition systems for various purposes

