

Kazakh Humanitarian-Juridical Innovative University
Faculty of Information technology and economy
Department of information technology sciences

8D061 COMPUTER SCIENCE

**THE CATALOGUE OF ELECTIVE
SUBJECTS**

Scientific and pedagogical directions

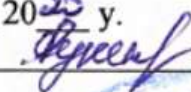
year of entry - 2020

Semey, 2020

Developed by the Department of information technology sciences

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Minutes № 5 from «07» 05 2020 y.

The head of Philology department  (Aukenov B.M.)

Considered and approved at the meeting of educational-methodic Council of the faculty

Minutes № 5 from «15» 05 2020 y.

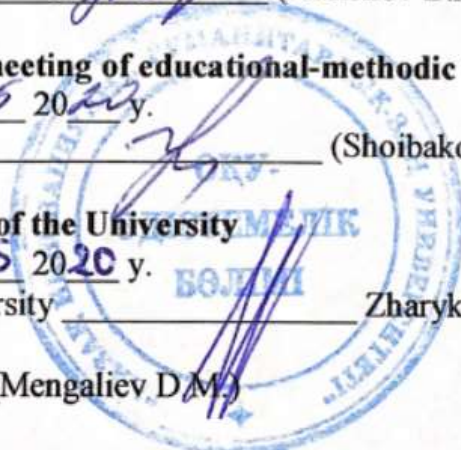
The head of EMC of the faculty  (Shoibakova E.O.)

Approved at the meeting of EMC of the University

Minutes № 5 from «21» 05 2020 y.

The chairman of EMC of the University  Zharykbasova K.S.

Adviser  (Mengaliev D.M.)



**Academic degree: doctor of philosophy PhD
in educational program: 8D061 –Informatics**

Group of education: D094-Information technology

№	Name of the discipline	Number of loans	Prerequisites	Postrequisites	Short description of the content, the aims of education, expected results (knowledge, abilities, skills, competencies)
Basic disciplines					
Elective courses (EC)					
1	Data mining methods	5	Software Development Technology	Neural network, The course of the foreign consultant "IT management services and content"	<p>Aims of study of discipline: Formation of an idea of the types of problems arising in the field of data mining and methods of solving them that will help the doctoral candidate to identify, formalize and successfully solve the practical problems of data analysis arising in the course of their professional activities</p> <p>Short maintenance of discipline: The empirical hypothesis. Strengthening of empirical hypotheses. The theory of measurements. Measures of proximity in space of different types. Classification of data analysis tasks. Basic hypotheses. Statistical formulation of the problem of pattern recognition. Bayesian decision rule. Parametric and nonparametric approaches to recognition. Heuristic algorithms for pattern recognition. Statistical and combinatorial statements of the taxonomy problem. Basic algorithms for solving the taxonomy problem. Choice of a system of informative signs. Tasks of a combined type. The problem of natural classification. Technologies for comparing data analysis algorithms for specific tasks and series of tasks.</p> <p>Expected result: know: the main tasks and methods of data mining; owns a culture of thinking, is capable of generalizing, analyzing, perceiving information, setting goals and choosing ways to achieve it; be able to: formulate the tasks of data analysis, select adequate algorithms for their solution, and evaluate the quality of the solutions obtained. Possesses the skills in the process of professional activity to identify the emerging problems of data analysis, knows how to formalize them and determine the most appropriate methods</p>

					for their solution.
1	Modern concept building systems	5	Software Development Technology	Neural computations and their application, The theory of digital signal processing and pattern recognition	<p>Aims of study of discipline: to familiarize with approaches to the development of information systems, the sequence of the transition from the conceptual model in the development of an information system to a detailed description of the system being developed, the methodology of developing information systems in an application to economic and business-oriented information systems, using flexible software development methodologies, the fundamentals of the development of interfaces, including speech, for information systems.</p> <p>Short maintenance of discipline: The concept of information system (IS). The life cycle of software. Methodical aspects of designing information systems. The process of requirements management. General principles of IS design. Unified Modeling Language Unified Modeling Language (UML)</p> <p>Expected result: know: the basics of information systems; formal models of systems; model 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. be able to: develop models of subject areas; conduct research on the characteristics of components and information systems in general; to apply in practice methods and means of designing information systems; assess the quality of the project information systems; to control the development of project documentation. own skills: the analysis of information systems; development of mathematical models of information systems; formation and registration of specifications of requirements in conditions of flexible programming technologies. be competent in organizing and conducting analysis and synthesis of information systems.</p>
2	Neural network	5	Intelligent Information Systems	Scientific research work of the	<p>Aims of study of discipline: The course is devoted to the study of classical neural network models, the construction of</p>

				doctoral student	<p>neural networks for solving various applied problems</p> <p>Short maintenance of discipline: Biological aspects of nervous activity. Neuron. Axon. Synapse. Reflex arc. The formal McCulloch-Pitts neuron. Neuron in the perceptron of Rosenblatt. Representativeness and learning ability of the perceptron. The problem of the "exclusive OR" function. Linear separability. Overcoming the problem of linear separability. Pattern recognition. Perceptrons. Prototypes of problems: approximation of multidimensional functions, classification of images. Recurrent networks. Neural network optimization. Preprocessing of data. Fuzzy neural networks</p> <p>Expectedated result: master the skills of setting and solving problems using various neural network models. give skills in setting and solving various types of tasks with the help of neural networks; to teach the choice of adequate neural network models and algorithms for solving the above problems. Doctoral students should be able to choose an adequate algorithm for solving this or that problem.</p>
2	Neural computations and their application	5	Intelligent Information Systems	Scientific research work of the doctoral student	<p>Aims of study of discipline: acquaintance with the new field of informatics and training in the qualified use of the apparatus of neural networks for solving applied problems.</p> <p>Short maintenance of discipline: Introduction to neural computing. Principles of organization and functioning of ANN. The first INS. Perceptron. Adaptive linear element. Associative networks. Data transformation networks. Preparation of data for INS training. Prospects for the development and application of INS and neurocomputers</p> <p>Expectedated result: know: the basic principles of the organization of information processes in neurocomputer systems; the main architectures of neurocomputer systems and their applications; basic methods and rules of training of neurocomputer systems; have the skills to develop and implement software models of neurocomputer</p>

					systems; be able to make assessments and compare the quality of training and the functioning of various models of neurocomputer systems.
3	Reliability and safety in cloud computing	5	Languages of knowledge representation	Scientific research work of the doctoral student	<p>Aims of study of discipline: give a general idea of modern presentation languages; show different ways of writing operators that implement any algorithm (follow, fork, repetition); inculcation of practical skills for the implementation of the tasks of the given subject area</p> <p>Short maintenance of discipline: Effective use of information and technological resources of a distributed computer system, taking into account the requirements of information security. Means of increasing the reliability of distributed computing systems. Analysis of methods to ensure functional reliability and requirements to the technical characteristics of the network management system.</p> <p>Expectedated result: know: required for the implementation of cloud technology hardware and software; to protect cloud technology modern methods; the essence of innovative means of cloud computing; be able to: choose modern electronic equipment for the implementation of cloud technology; design information systems using innovative tools; possess: skills of operation of modern electronic equipment used for the security of cloud technology.</p>
3	Computer integrated technologies in electronics	5	Languages of knowledge representation	Scientific research work of the doctoral student	<p>Aims of study of discipline: learn how to use the basic software packages (Matlab, Octave, Scilab, OMatrix, etc.), specialized packages for solving partial differential equations (ANSIS, FlexPDE, FemLab, FreeFEM), modeling of electronic devices (MicroCap, Electronics Workbench).</p> <p>Short maintenance of discipline: 2D - graphics Matlab clone and GNUPlot. Main functions and their properties. 3D graphics Matlab clone and GNUPlot. Main functions and their properties. Functions of 3D visualization. Full and sparse matrices. Indexing. Matrix and scalar functions. Elements of programming in Matlab clone environments. Commands, variables,</p>

					<p>keywords, operators, flow control calculations. Read and interpret standard sound and image files. The concept of one-dimensional and two-dimensional digital filtering. Interpolation. Application for sound processing and images. ODE is the Solver. Initial and boundary value problems. Bloch equations, π and $\pi / 2$ pulses, spin echo. Natural cantilever frequencies. MFI. FreeFEM and FlexPDE. Description of the domain and statement of boundary value problems. Maxwell's equations, electrostatics and magnetostatics. Export data and visualize fields using Matlab. Optimization functions. Application to the problem of fitting experimental data. Programs of circuit simulation. PSpice, MicroCap, Electronics Work bench. Simulation of circuits on transistors and op amps.</p> <p>Expectedated result: to know: the basic information structures used in mathematical modeling (variables, arrays, vectors, matrices, classes), methods of creation, import / export and operation with these structures; most often used in scientific research mathematical models (algebraic and transcendental systems of equations, ODE, MFI, filtration, optimization); standards for the presentation and storage of experimental data, methods for 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 mathematical and specialized software; master the skills: modern information and information and communication technologies and tools for solving general scientific problems in their professional sphere and for organizing work; be competent - in the conduct of scientific research using computer technology.</p>
Main disciplines					
Elective courses (EC)					
1	Analysis and risk assessment in the management of information security	5	The study and analysis of algorithms	Scientific research work of the doctoral student	Aims of study of discipline: is the study of methods and tools of information security management in the organization, as well as the study of the main approaches to the development, implementation, operation, analysis,

				<p>maintenance and improvement of information security management systems (ISMS) of a certain object</p> <p>Short maintenance of discipline: Fundamentals of IS management. Control systems IB. Basic issues of IS management. Standardization in the field of IS management. Fundamentals of risk management IB. Management processes IB. Risk analysis IS. The role of the ISMS. Implementation of the developed processes. The document "Regulations on applicability". Select the scope of the ISMS. Development of methods for assessing the risks of information security. Organization of work of security service of the enterprise. Designing a separate ISMS process for a particular facility</p> <p>Expected result: know: modern approaches to the management of information security and the directions of their development; the main standards governing IS management; principles of ISMS construction; the principles of developing IS management processes; be able to: analyze the current state of information security in the enterprise in order to develop requirements for the development of IS management processes; To determine the goals and tasks solved by the developed IS management processes; apply a process approach to the management of information security in various fields of activity; Own: skills management information security of simple objects</p>
1	Parallel programming with CUDA	5	The study and analysis of algorithms	<p>Scientific research work of the doctoral student</p> <p>Aims of study of discipline: providing knowledge of the features of working with CUDA technology and ways to optimize programs.</p> <p>Short maintenance of discipline: Multi-core systems. Differences between CPU and GPU architectures. History of the development of GPU. Application of calculations on the GPU. Installation of NVIDIA CUDA. Installing on Windows. Installing CUDA under Linux. The basics of CUDA. General concepts. Types of memory. Expanding the C language. Examples of programs. The first program. Libraries of CUDA. CUBLAS. CUSPARSE.</p>

					<p>Expecteded result: In studying the course, doctoral students should: Know: using a video card for non-graphical computing in scientific work. Be able to: create parallel programs for computing systems with distributed, shared memory; Parallelize the computational algorithms; master the skills: in building parallel analogs of computational algorithms; be competent: in formulating the main problems of the subject area, apply universal methods and tools for their solution; the ability to develop algorithms, computational models and data models for the implementation of the functionality of information systems and software.</p>
2	The course of the foreign consultant "IT management services and content"	5	Methods of data mining	Scientific research work of the doctoral student	<p>Aims of study of discipline: to generate knowledge about modern trends in management of integrated services, platforms, content.</p> <p>Short maintenance of discipline: IT service is the basis of the activity of the modern IS service. ITIL / ITSM is the conceptual basis of the IS-service processes. Main functions of content management systems. Classification of content management systems: ECM, CMS, Framework, corporate portal. Solutions and systems in the field of ECM. Solutions and systems in the field of corporate portals. Content management in CMS 1C-Bitrix.</p> <p>Expecteded result: know: the 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 life cycle of enterprise content and Internet resources, manage the creation and use of information services (content services; own methods of managing 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 a technical solution for the creation of content management systems for Internet resources and enterprise content management systems</p>

2	The theory of digital signal processing and pattern recognition	5	Modern concept of building systems	Scientific research work of the doctoral student	<p>Aims of study of discipline: research of image quantization methods, their reconstruction and scaling by means of interpolation methods, image enhancement using linear and nonlinear spatial and frequency filtering techniques, and reduction of image redundancy using image compression methods based on discrete cosine and wavelet transformations.</p> <p>Short maintenance of discipline: Basic forms and methods of perception. Operating diagram of the procedure for perception. Detection and recognition. Detection task. Statistical detection criteria. Basic concepts. The task of recognition. Images and classes of images. The concept of the problem of classification and recognition. Classification of recognition methods. Spectral and correlation methods of recognition. Correlators. Analyzers of spectra of random processes. Digital analysis of spectra. Correlation-difference method. Methods of recognition by slices and projections. Use of histograms when recognizing images.</p> <p>Expectedated result: In studying the course, doctoral students should: know: the scientific basis and methods of working with digital information processing; modern methods of digital information processing on the object of informatization on the basis of domestic and international standards; methods and means of digital processing of information; role and tasks of methods and tools for pattern recognition in modern information-control and information-computing systems of various purposes; modern approaches to the construction of systems for pattern recognition; system of pattern recognition as an object of information impact, criteria for evaluating its effectiveness and methods for ensuring its effectiveness; be able to: choose and analyze indicators and quality criteria for individual methods of pattern recognition and pattern recognition systems in general; to use modern scientific and technical information on the problems and problems of pattern recognition;</p>
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				<p>Apply the acquired knowledge in the course projects and final qualification works, as well as in the course of scientific research; own skills: analysis and objective quantification of the effectiveness of certain methods and algorithms for pattern recognition; formal formulation and solution of the problem of constructing image recognition systems for various purposes; Be competent: formulate in the form of theorems and prove statements about potentially achievable estimates of the computational effectiveness of certain methods of pattern recognition; formalize the requirements and limitations for the development of pattern recognition systems using various methods and algorithms and to measure real characteristics with theoretical results</p>
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LIST OF COMPONENTS BY CHOICE
for an educational program
8D061– «Computer science»

Studying term: Full-time 3 years

Group of education: D094-Information technology

Name of the discipline	Code of discipline	Number of loans	Semester
Base disciplines			
Component on a choice 1			
Data mining methods	DMM7203	5	1
Modern concept building systems	MCBS7203	5	
Component on a choice 2			
Neural network	NN7204	5	2
Neural computations and their application	NCA7204	5	
Component on a choice 3			
Reliability and safety in cloud computing	RSCC7305	5	2
Computer integrated technologies in electronics	CITE7205	5	
Main disciplines			
Component on a choice 5			
Analysis and risk assessment in the management of information security	ARAMIS7304	5	2
Parallel programming with CUDA	PPC7304	5	
Component on a choice 6			
The course of the foreign consultant "IT management services and content"	CFC7305	5	2
The theory of digital signal processing and pattern recognition	TTDSPPR7305	5	