THE CATALOGUE OF ELECTIVE SUBJECTS

7M06110-INFORMATICS

year of entry - 2024

Semey, 2024

Considered and approved at the meeting of educational-methodic Council of the faculty
Minutes № 4 from «15» __03__ 2024 y.

The head of EMC of the faculty _____ (Shojbakova E.O.)

Approved at the meeting of EMC of the University
Minutes № 5 from «28» __05___ 2024 y.

The chairman of EMC of the University _____ (Zharykbasova K.S.)

№ p/p	Name of discipline	Number of credits	Prerequisites	Postrequisites	Short description of the content, the aims of education, expected results (knowledge, abilities, skills, competencies)
				Basic disciplines	
				Elective courses (EC)	
1	Methodological fundamentals of scientific research and planning experiments in computer science	5	World information resources	Modern project management technologies, Cryptographic Information Protection	**The purpose of the discipline** is to form a system of knowledge about the theoretical and methodological foundations of scientific research and about the main components of the scientific research process. Development of the ability to use theoretical knowledge in scientific experimental research, analytical and teaching activities. Formation of ideas about the need to implement the obtained results in production, science and education. Ensuring the required level of academic and professional competencies of students. **Expected result:** **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; **to be able to:** identify promising areas of scientific research in the subject area of professional activity, the composition of research papers, their determining factors - to build the logic of empirical experimental research, collection, processing and interpretation of the data obtained on the material collected for their scientific research; to choose the necessary research methods, modify existing ones based on the objectives of a specific study, interpret the results of experimental research; formulate your own position based on the objectivity of theoretical assumptions and experimental data; process the results obtained, analyze and comprehend them taking into account the available data, use the knowledge of ethical norms when assessing the consequences of your professional activity.

					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 collecting, processing and interpreting the data obtained; ways of understanding and critical analysis of scientific information. **Competencies:** 1. **Research competencies:** **-** The ability to develop and select methods and tools for conducting research, including the definition of research questions and hypotheses. 2. **Professional competencies**: - ability to plan, organize and conduct scientific research in the field of computer science; conduct correct processing of experimental results with their further presentation in the form of scientific reports, reports, publications and presentations; substantiation of conclusions and conclusions.
1	Basic research	5	World information resources	Project management vethods, Information security technologies	**The purpose of the discipline**: preparation for scientific, technical, organizational and methodological activities related to scientific research: formulation of the task; organization and conduct of research, including the organization of the work of the scientific team; registration of research results; evaluation of the effectiveness of the developed proposals and their implementation. Engineering creativity. Creativity in scientific and design work. An overview of the methods of technical creativity. Methods of scientific research in engineering. General information about scientific research. Classification of research methods. Feasibility study and research. Information and patent search. Setting up an experiment. Systematization of information. Research planning. An experiment in research. Mathematical processing of experimental results. Registration of research results. Approximation of the experimental results. Ensuring the integration of science, higher education and the labor market. The development of the required level of research skills among students.. **Expected result:** **to know**: the basic logical methods and techniques of scientific research, methodological theories and principles of modern science, the basis of modern computer technology, criteria for the dependence of features and data uniformity, criteria for the significance of parameters, principles of choosing the most powerful criteria. **be able to:** carry out methodological substantiation of scientific research, evaluate the effectiveness of scientific activity, use

					network technologies and multimedia in education and science; choose criteria parameters depending on product quality requirements and production costs, formulate a research task based on production needs, identify distribution functions, justify criteria parameters. **possess:** logical and methodological analysis of scientific research and its results, application of mathematical methods in technical applications, implementation of patent search, planning of scientific experiment, skills of public speech, argumentation, discussion and polemic, skills of cooperation and negotiation. **Competencies:** 1**. Research competencies:** **-** The ability to develop and select methods and tools for conducting research, including the definition of research questions and hypotheses; 2. **Professional competencies**: - ability to plan, organize and conduct scientific research in the field of computer science; conduct correct processing of experimental results with their further presentation in the form of scientific reports, reports, publications and presentations; substantiation of conclusions and conclusions.
2	Technologies of teaching disciplines of specialty	5	Methodological basis of scientific research and experiment planning in computer science	Intelligent platforms	**Content**: The discipline is the development of normative, scientific, psychological and pedagogical foundations of the structure and content of the general computer science course, methods, tools, technologies and organizational forms of teaching computer science at the university. As well as the formation of a system of competencies in the use of information and communication technologies in educational and cultural activities. **Expected result:** **to know:** the main normative and legal documents on higher education in the Republic of Kazakhstan, the main methodological and technological methods of teaching at the university; **to be able to:** develop thematic and lesson plans, develop didactic material for the lesson; **possess:** independent analysis of the process of teaching computer science and computer cycle disciplines, independent planning and development of laboratory and practical work on disciplines, the use and development of modern educational and methodological support for teaching computer science. be competent: in providing computer and technological support for the activities of students in the educational process and

					extracurricular activities; in modern information and communication technologies for the creation, formation and administration of electronic educational resources; in assessing the quality of electronic educational resources and software and technological support for their implementation in the educational process. **Competencies:** 1. **Pedagogical competencies:** - the ability to independently conduct lectures, seminars, practical classes and laboratory workshops using modern educational technologies; plan and organize the independent work of students.
2	Information technologies in teaching	5	Methodological basis of scientific research and experiment planning in computer science	Smart technologies in education	**Content:** Information technologies in contact training (classroom e-lectures and practical training with the use of information technology). The technical component of the modern contract of training. Principles, technologies and means of creating electronic content and electronic educational and methodical publications. Organization of virtual educational space (distance learning). Automated distance learning systems. Educational and scientific site building. **Expected result:** **to know:** the theoretical foundations of the culture of thinking and the features of its functioning in the professional activity of a teacher in the field of information technology in education; psychological features of human perception of information. **to be able to:** analyze and summarize information in the logic of traditional forms of scientific knowledge in the field of information technology in education; use theoretical thinking to solve current problems and tasks in the field of information technology in education. **possess:** techniques of theoretical thinking as a way of mastering reality and practical activities in the field of information technology in education; skills of developing their own ways of thinking that meet the requirements of human culture in the field of information technology in education. **Competencies:** 1. professional (pedagogical: teaching) competencies (PC 4): - the ability to independently conduct lectures, seminars, practical classes and laboratory workshops using modern educational technologies; plan and organize the independent work of students.
3	Modern pedagogical technologies	5	Technologies of teaching specialty	Writing dissertations	**Content:** Pedagogical technologies. Classification of pedagogical technologies. Traditional and innovative pedagogical

| | | | disciplines | | technologies. Modern educational technologies as an objective need. Technologies of personality-oriented learning. Critical thinking technologies. Case technologies. Technologies of creative workshops. Technologies of problem-based learning. Computer (information) technologies. Technologies of programmed learning. Modular learning technologies. Integrated learning technologies. **Expected result:** **to know**: the concept of pedagogical technology, its structure, the methodology of pedagogical technology and the peculiarities of the use of pedagogical technology in the educational process. **to be able to:** design, predict and design pedagogical technologies in professional pedagogical activity; apply pedagogical technologies in the pedagogical process of a modern school. **possess**: creative use of new technologies in professional activity. **Competencies:** 1. **Pedagogical competencies:** - the ability to independently conduct lectures, seminars, practical classes and laboratory workshops using modern educational technologies; plan and organize the independent work of students. |
| 3 | Pedagogical ethics of a modern teacher | 5 | Information technologies in teaching | Writing dissertations | **Content:** The subject and objectives of pedagogical ethics. The origin and interrelation of the concepts of "ethics", "morality", "morality", "etiquette"; functions and ethical principles of pedagogical communication; the teacher's communication style and its influence on the training, upbringing and development of the student's personality; the concept of communication, its features, styles, forms; ethics of relations in the system of "teacher-student", "teacher-teacher", "teacher-administration"; Features and possibilities of remote communication; The image of a teacher as a guarantee of professional success. **Expected result:** **to know:** historical aspects of the formation of ethics as a science; theoretical foundations of ethics, its conceptual and categorical apparatus; **to be able to:** apply ethical norms and standards in professional practice; independently navigate ethical problems and ways to resolve them; apply general moral norms and requirements of professional ethics in practice. **possess**: possess the conceptual apparatus of professional ethics of a specialist; methodological approaches to the choice of theoretical tools appropriate to the task being |

1					solved; culture of communication in professional and everyday life, skills of public speech, argumentation, discussion. **Competencies:** 1. **Pedagogical competencies:** - the ability to observe pedagogical tact, the rules of pedagogical ethics; to show respect for the personality of students; to adhere to a democritical style in relations with students; to show commitment to the highest social values, to the ideas of humanistic pedagogy; to show familiarity with the system of universal and national values in their unity; to build the educational process with thevolume of national priorities of Kazakhstan; to resist all types of discrimination, extremism; the ability to solve moral and ethical problems that may arise in pedagogical activity. 2. General professional competencies (OPK 2): - the ability to lead a collective in the field of their professional activities, tolerantly perceiving social, ethnic, confessional and cultural differences.
				Main disciplines	
				Elective courses (EC)	
1	Algorithms and their complexity	4	Algorithms and data structure	Interfaces of software systems	**The purpose of the discipline**: it is aimed at a wide range of knowledge and skills for data analysis, forecasting and decision-making, including key aspects of building machine learning models, applying technologies, developing software tools for data analysis and designing neural networks. Algorithmization, data structures and programming, algorithms for processing big data.. **Expected result:** **to know:** develop algorithms for specific tasks; find the complexity of algorithms; **to be able to:** basic models of algorithms, methods of constructing algorithms, calculating the complexity of algorithms; **possess**: about methods of proving the correctness of algorithms for typical mass problems, about methods of proving the unsolvability of mass problems. **Competencies:** 1. **Professional competencies:** - ability to understand the skills of using computer technology, programming tools for the effective implementation of hardware and software complexes and possession of practical skills of object-oriented analysis, design and programming;
1	Estimation of the complexity of algorithms	4	Algorithms and data structure	Artificial intelligence and decision theory	**Purpose of the discipline:** The discipline covers the concept of complexity of algorithms, methods for measuring and assessing their effectiveness, and also examines effective algorithms for solving

					problems, including algorithms for sorting and retrieving information. Includes building strategic assessment models and data management in artificial intelligence. **Expected result:** **to know**: the complete set of initial data of the task (the initial state of the object); the purpose of creating the algorithm (the final state of the object); the system of commands of the performer (that is, a set of commands that the performer understands and can execute), the general solution of a large class of recurrent equations; **to be able to:** use algorithm development methods; perform dynamic programming, search with return; use local search algorithms; **possess**: finding and using effective programming algorithms. **Competencies:** 1. **Professional competencies:** - ability to understand the skills of using computer technology, programming tools for the effective implementation of hardware and software complexes and possession of practical skills of object-oriented analysis, design and programming;
2	Cloud computing and virtualization	4	Algorithms and their complexity	Big Data technologies	**The purpose of the discipline**: to study the principles of cloud computing; popular virtualization platforms; deployment of servers in a virtual environment and virtualization services (Google, Microsoft, RedHat, etc.); software as a service (SaaS) and platforms as a service trend (PaaS), mastering the skills to design virtualization platforms from different suppliers for project deployment, as well as implement Saas and PaaS architectures in projects; mastering the skills of software development for cloud systems, system administration for the development and maintenance of applications deployed in the clouds. **Expected result:** **to know**: knowledge and understanding of the implementation of cloud computing technologies; **to be able to**: use cloud technologies in software development; **possess**: professional communication on cloud technology issues. **Competencies:** 1. **Professional competencies:** - possess knowledge of regulatory and legal documents in the field of IT technology, instructional documentation, skills and abilities to develop current technical documentation of a software product and system, possess organizational skills, show high performance discipline;

| 2 | Pattern recognition theory | 4 | Algorithms and their complexity | Big Data technologies | **The purpose of the discipline:** to study pattern recognition techniques; generalization of theoretical issues of pattern recognition; development of algorithms for neural network learning methods for pattern recognition; development of new methods of pattern recognition using neural networks; determination of methods for constructing algorithms; evaluation of the effectiveness of pattern recognition methods, skills in optimal selection and correction of data representation forms and knowledge of their application algorithmic and software for creating simple architectures of image recognition systems; mastery of the skills of optimal selection and correction of data forms and knowledge and techniques of algorithmic and software and other means of improving the architectures of RO and OI systems using fuzzy logic.
 Expected result:
 to know: various approaches to the construction of pattern recognition systems, and methods with fields such as mathematical statistics, data mining, machine learning, computer vision;
 to be able to: apply the basic principles of the theory of precedent learning, clustering methods, classification methods, regression analysis methods, use methods of analyzing multidimensional data, methods of reducing the dimensionality of data;
 possess: the construction and interpretation of formal mathematical models in terms of the applied field, solving applied problems with the selection of appropriate methods and software for pattern recognition.
 Competencies:
 1. **Professional competencies:**
 - possess knowledge of regulatory and legal documents in the field of IT technology, instructional documentation, skills and abilities to develop current technical documentation of a software product and system, possess organizational skills, show high performance discipline; |
| 3 | Cryptographic Information Protection | 4 | Methodological basis of scientific research and experiment planning in computer science | Writing dissertations | **Content:** While studying the discipline, students will learn the basic principles of information security using cryptographic methods and examples of implementing these methods in practice.
 Expected result:
 to know: the concept and areas of application of automated information systems; fundamentals of software system design, principles of software testing;
 to be able to: use the basics of cryptographic messages; mathematical models of cipher texts; know: about cryptanalysis of cipher |

					models; about secret key management. **possess**: the skill of building cryptographic encryption algorithms and data transfer protocols. **Competencies:** 1. **Professional competencies:** - ability to understand the skills of using computer technology, programming tools for the effective implementation of hardware and software complexes and possession of practical skills of object-oriented analysis, design and programming;
3	Information security technologies	4	Basic research	Thesis work	**Content:** Mastering disciplinary competencies related to the disclosure of basic and advanced information security technologies for complex technical objects and systems. **Expected result:** **to know:** the structure of cryptographic messages; mathematical models of texts and ciphers; cryptanalysis of cipher models, secret key management; use basic cryptographic methods, protocols and algorithms; **to be able to:** use basic cryptographic methods, protocols and algorithms; develop effective encryption algorithms. **possess**: the structure of cryptographic messages; mathematical models of texts and ciphers; own: about cryptanalysis of cipher models; about secret key management. **Competencies:** 1. **Professional competencies:** - ability to understand the skills of using computer technology, programming tools for the effective implementation of hardware and software complexes and possession of practical skills of object-oriented analysis, design and programming;
4	Intelligent platforms	5	Cloud computing and virtualization	Writing dissertations	**The purpose of the discipline**: problematic issues and areas of use of intelligent information systems and technologies; theoretical and organizational and methodological issues of building and functioning of knowledge processing systems; practical work on designing knowledge bases, knowledge of mathematical apparatus for solving specific problems in the field of information systems and technologies; knowledge of methods for developing analytical and simulation models of information systems. **Expected result:** **to know:** the theory of modern information technologies; methods, methods and means of obtaining, storing and processing information. **to be able to:** apply information technologies in solving problems; use sources of economic, social, and managerial information. **possess**: information technology skills; modern

					methods of collecting, processing and analyzing economic and social data. **Competencies:** 1. **Professional competencies:** - ability to understand the skills of using computer technology, programming tools for the effective implementation of hardware and software complexes and possession of practical skills of object-oriented analysis, design and programming;
4	Smart technologies in education	5	Cloud computing and virtualization	Writing dissertations	**Content:** After studying the discipline, undergraduates will know the paradigm of smart education: principles and technologies; Smart technologies of collective learning: joint formation of educational content and communication; open educational resources as the basis of smart education; development of a system of evaluation activities of the e-course using smart education technologies **Expected result:** **to know:** the concepts of information technology and programming; general principles of program development; the concept of the life cycle of an information system; characteristics of the main IP processes; LC models; features of analysis and design); **to be able to:** carry out comparative analysis and design of CASE technology systems; work with various types of diagrams; work with elements of graphical notation; **possess:** the development of multimedia software, the use of various technologies in the development of multimedia tools. **Competencies:** 1. **Professional competencies:** - ability to understand the skills of using computer technology, programming tools for the effective implementation of hardware and software complexes and possession of practical skills of object-oriented analysis, design and programming;
5	Modern project management technologies	5	Methodological basis of scientific research and experiment planning in computer science	Writing dissertations	**Content:** The discipline is the training of professional project managers in accordance with international and national requirements for the competence of project management specialists and modern trends and technologies of project activity, as well as the formation of the ability to analyze the need for the use of project management technologies at different stages of the project cycle; to assess the place and role of project management technologies in various areas of the modern economy and IT sphere. **Expected result:** **to know:** the tasks of the project manager at all phases of the iterative-incremental software development cycle, the methodology of using

						PERT analysis to calculate the timing and budget of the project, typical risks of IT projects, their classification, risk management strategies, methods of monitoring the progress of the project; **to be able to:** draw up a work plan (a network diagram of work flows), assess labor costs and calculation of the project budget, calculate realistic project deadlines by PERT analysis, conduct a risk analysis; **to possess:** iterative-incremental software development cycle model, project planning and critical path, risk management in IT projects, financial justification of the project, present value and payback, project configuration management. **Competencies:** 1. **Professional competencies:** - possess knowledge of regulatory and legal documents in the field of IT technology, instructional documentation, skills and abilities to develop current technical documentation of a software product and system, possess organizational skills, show high performance discipline;
5	Project management methods	5		Basic research	Writing dissertations	**Content:** Project management history. A system of standards in the field of project management. Project, program. Classification of projects. Project goals and strategies. Project structures. Types and examples of structural project models used in the UP. The life cycle and phases of the project. Project management processes and functions. The concept of processes in project management. Basic and auxiliary processes in project management. Goal setting in projects. Calendar planning and organization of the project control system. Project risk management. Project personnel and communications management. Information technologies of project management. **Expected result:** **to know:** the modern methodology of project management, definitions and concepts of projects, programs and their context as objects of management; definitions and concepts of management subjects and tools used by them; history and trends in the development of project management; **to be able to:** analyze the goals and interests of the project; determine the goals, subject area and structures of the project; **possess**: (methods, techniques) teamwork skills in projects; self-management techniques for simple projects; be able to effectively participate in team work in complex projects. **Competencies:** 1. **Professional competencies:** - possess knowledge of regulatory and legal

					documents in the field of IT technology, instructional documentation, skills and abilities to develop current technical documentation of a software product and system, possess organizational skills, show high performance discipline;
6	Big Data technologies	5	Algorithms and their complexity	Writing dissertations	**Content:** The course "Big Data Technology" aims at: the formation of professional competence among undergraduates in the field of development and use of systems for processing and analyzing large amounts of data. This goal correlates with the purpose of the educational program, in particular, with the technologies for developing specialized software systems responsible for processing big data. **Expected result:** **to know**: methods of analysis and storage of large amounts of data, stages the life cycle of big data processing, the languages most adapted for processing and analytics of big data, ways of organizing storage and access to big data; **to be able to:** perform data analysis elements and interpret the results, distinguish between the characteristics of SQL and NoSQL databases, formulate algorithms in the MapReduce paradigm, choose a suitable big data analysis tool, choose a suitable big data storage technology.; **possess**: mathematical methods of data analysis, languages and computer processing methods. **Competencies:** 1. **Professional competencies:** - ability to understand the skills of using computer technology, programming tools for the effective implementation of hardware and software complexes and possession of practical skills of object-oriented analysis, design and programming;
6	Data processing and storage technologies	5	Estimation of the complexity of algorithms	Writing dissertations	**Content:** The course consists of two parts that complement each other. The first talks about data storage methods in modern enterprise infrastructures. Promises receive information about the types of storage systems and the features of their use in classic and cloud environments of enterprises, learn about the architecture of solutions, the algorithms underlying storage systems, and gain an understanding of SAN networks. The second part is devoted to an introduction to the problem of big data and the development of high-load services. **Expected result:** **to know**: IT architecture of a modern enterprise in terms of systems that provide storage and processing of large amounts of

7					data, knowledge of algorithms and techniques for working with highly loaded services. **to be able to:** use modern data storage systems. The ability to analyze the architecture of a modern enterprise and data processing centers, to choose protocols and technologies for building the virtual infrastructure of the enterprise. **possess**: methods for developing high-load services. Acquisition of skills to work with modern big data processing libraries. **Competencies:** 1. **Professional competencies:** - ability to understand the skills of using computer technology, programming tools for the effective implementation of hardware and software complexes and possession of practical skills of object-oriented analysis, design and programming;
7	Interfaces Software Systems	5	Cloud computing and virtualization	Writing dissertations	**Content:** The content of the discipline covers a range of issues related to the design of user interfaces of software systems, the use of various methodologies and technologies for designing user interfaces of software systems. User interfaces in their relationship with application-level hardware and software interfaces. Models and metaphors. Concepts and interrelation. The mental model. Properties of mental models. Mental models of various participants in the process of developing and using software systems. **Expected result:** **to know**: features of the received estimates. methods of engineering-psychological and ergonomic design of human-machine systems; methods of system-wide design of interfaces for human-computer environment interaction, **to be able to**: formulate requirements for hardware and software that ensure operator interaction with the computing environment; **possess**: make a choice and justification of design solutions for the organization of computer system interfaces. **Competencies:** 1. **Professional competencies:** - possess knowledge of regulatory and legal documents in the field of IT technology, instructional documentation, skills and abilities to develop current technical documentation of a software product and system, possess organizational skills, show high performance discipline;
7	Artificial intelligence and decision theory	5	Cloud computing and virtualization	Writing dissertations	**Purpose of the discipline**: studying the concept of artificial intelligence; architecture and components of AI systems; fuzzy logic control systems; structure and operating principle of a fuzzy logic system; neural networks and neural network control; problems

| | | | | | of linear and nonlinear programming, dynamic programming; queuing systems, ability to develop database management systems, debugging and maintenance, documentation of the database management system being developed; skills in developing operating systems and their architecture; skills in writing operating system components, debugging and maintenance, documenting the operating system being developed. **Expected result:** **to know**: methods and means of knowledge representation, methods and means of knowledge representation; **to be able to**: use the methods of finding solutions used in artificial intelligence systems, **possess**: new methods and approaches to solving traditional problems developed within the framework of artificial intelligence. **Competencies:** 1. **Professional competencies:** - possess knowledge of regulatory and legal documents in the field of IT technology, instructional documentation, skills and abilities to develop current technical documentation of a software product and system, possess organizational skills, show high performance discipline; |

LIST
of elective courses
for an educational program
7M06110 - INFORMATICS

Form of education: Full-time
Studying term: 2 years   **Year of entry - 2024**

Name of the discipline	Code of discipline	Number of loans	Semester
Basic disciplines			
Elective course 1			
Methodological foundations of scientific research and experimental planning in computer science	MFSREP5206	5	1
Basic research	BR5206	5	1
Elective course 2			
Technologies of teaching specialty disciplines	TTSD5207	5	2
Information technologies in teaching	ITT5207	5	2
Elective course 3			
Modern pedagogical technologies	MPT6208	5	3
Pedagogical ethics of a modern teacher	PEMT6208	5	3
Main disciplines			
Elective course 1			
Algorithms and their complexity	ATC5304	4	2
Estimation of the complexity of algorithms	ECA5304	4	2
Elective course 2			
Cloud computing and virtualization	CCV5305	4	2
Pattern recognition theory	PRT5305	4	2
Elective course 3			
Cryptographic Information Protection	CIP5306	4	2
Information security technologies	IST5306	4	2
Elective course 4			
Intelligent platforms	IP6307	5	3
Smart technologies in education	STE6307	5	3
Elective course 5			
Modern project management technologies	MPMT6308	5	3
Project management vethods	PMV6308	5	3
Elective course 6			
Big Data technologies	BDT6309	5	3
Data processing and storage technologies	DPST6309	5	3
Elective course 7			
Interfaces of software systems	ISS6310	5	3
Artificial intelligence and decision theory	AIDT6310	5	3