THE CATALOGUE OF ELECTIVE SUBJECTS

7M06110-INFORMATICS

year of entry - 2023

Semey, 2023

Considered and approved at the meeting of educational-methodic Council of the faculty
Minutes № 5 from «15» __05__ 2023 y.

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

Approved at the meeting of EMC of the University
Minutes № 5 from «25» __05___ 2023 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 foundations of scientific research and experimental planning in computer science	5	World information resources	Modern project management technologies, Cryptographic Information Protection	**Content:** The discipline is the formation of a system of knowledge about the theoretical and methodological foundations of research activities and about the main components of the research process. Development of the ability to use basic theoretical knowledge in scientific experimental research, analytical and teaching activities. Formation of ideas about the need to implement the results obtained in production, science and education. **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; 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

3

					critical analysis of scientific information. **Competencies:** 1. General professional competencies (GPC 1): - the ability to improve their professional activities in the field of computer science and science, prospects and trends in the development of information technology; 2. professional (research) competencies (PC 1): - 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	**Content:** Engineering creativity. Creativity in scientific and design work. Overview of 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. **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. General professional competencies (GPC 1): - the ability to improve their professional activities in the field of computer science and

					science, prospects and trends in the development of information technology; 2. professional (research) competencies (PC 1): - 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 specialty disciplines	5	Methodological basis of scientific research and experiment planning in computer science	Intelligent information systems and technologies	**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; 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. 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.
2	Information technologies in teaching	5	Methodological basis of scientific	Smart technologies in education	**Content:** Information technologies in contact training (reading classroom electronic lectures and conducting practical classes using

			research and experiment planning in computer science		information technology). The technical component of modern contact training. Principles, technologies and means of creating electronic content and electronic educational and methodical publications. Organization of a virtual educational space (distance learning). Automated distance learning systems. Educational and scientific site construction. **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. 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 disciplines	Writing dissertations	**Content:** Pedagogical technologies. Classification of pedagogical technologies. Traditional and innovative pedagogical 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. be able to: design, predict and design pedagogical technologies in professional pedagogical activity; apply pedagogical

3					technologies in the pedagogical process of a modern school. own: creative use of new technologies in professional activity. **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	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; 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 solved; culture of communication in professional and everyday life, skills of public speech, argumentation, discussion. **Competencies:** 1. professional (pedagogical: educative) competencies (PC 5): - 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	**Content:** The study of algorithms allows you to delve deeper into the problem and can suggest solution methods that do not depend on the programming language, programming paradigm, hardware and other aspects of implementation. An important component of knowledge in the field of computer science is the ability to choose an algorithm suitable for solving a given problem, or to prove that such an algorithm does not exist. This ability is based on knowledge of a class of algorithms that are designed to solve a certain set of known problems, understanding their strengths and weaknesses, and the applicability of various algorithms in this context. Efficiency is the most important issue in this area. **Expected result:** know: develop algorithms for specific tasks; find the complexity of algorithms; be able to: basic models of algorithms, methods of constructing algorithms, calculating the complexity of algorithms; to know: about methods of proving the correctness of algorithms for typical mass problems, about methods of proving the unsolvability of mass problems. **Competencies:** 1. professional (professional-activity) competencies (PC 2): - 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	The life cycle of the software	**Content:** The discipline is aimed at studying the concept of algorithm complexity, measuring and evaluating algorithm complexity, effective algorithms for solving problems and evaluating basic algorithms for sorting and searching information. Consideration of the types of functions of complex algorithms and the mathematical apparatus of algorithm analysis. The study of the calculation of the number of operations performed, the asymptotic notation used in the analysis of the growth rate and the comparison

№					
					of the complexity of algorithms. **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; 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 (professional-activity) competencies (PC 2): - 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	Technology of object-oriented analysis and design	4	Algorithms and their complexity	Big Data technologies	**Content:** The discipline is the formation of the necessary theoretical base and practical skills that will allow you to comprehensively and systematically see the stages and process of software development. The basic stages of the process of creating software systems are analysis and modeling (design). The main objective of the course is to form a holistic understanding of the methods and approaches of object-oriented analysis and design of software and hardware complexes, to help master the practical experience of programming in C++ and designing software products using the unified modeling language UML (Unified Modeling Language) in the Rational Rose environment. **Expected result:** to know the evolution and brief description of the main approaches to the development of information models of business systems and business processes; be able to develop graphical notation and the specifics of its use in the process of creating scalable software systems to possess: analysis of requirements for automated information systems. **Competencies:** 1. professional (professional-activity) competencies (PC 3): - 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	Analysis of requirements for automated information systems	4	Programming algorithm	Data processing and storage technologies	**Content:** The course contains information about the analysis of requirements as an engineering discipline. Classifications of requirements are given, properties of requirements are analyzed, methodologies, standards, notations, artifacts of working with requirements are considered. The components of the requirements analysis are analyzed in detail - identification, specification and documentation, verification. **Expected result:** to know: the concept and areas of application of automated information systems; fundamentals of software system design, principles of software testing; be able to: practically use modern software of modern computer technology; own: conducting an analysis of requirements for automated information systems. **Competencies:** 1. professional (professional-activity) competencies (PC 3): - 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:** Studying the discipline, undergraduates will master the fundamental principles of information protection using cryptographic methods and examples of the implementation of 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; 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 (professional-activity) competencies (PC 2): - 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	4	Basic	Thesis work	**Content:** Mastering disciplinary competencies

4	technologies		5	research	related to the disclosure of basic and advanced information security technologies for complex technical objects and systems. **Expected result:** 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; be able to: use basic cryptographic methods, protocols and algorithms; develop effective encryption algorithms. own: the structure of cryptographic messages; mathematical models of texts and ciphers; own: about cryptanalysis of cipher models; about secret key management. **Competencies:** 1. professional (professional-activity) competencies (PC 2): - 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 information systems and technologies		5	The technology of object-oriented analysis and design	Writing dissertations	**Content:** Having studied the discipline, undergraduates will know: fundamentals of intelligent information systems; intelligent information systems; knowledge representation; expert systems; data mining; intelligent information systems; knowledge representation; fundamentals of programming in "prologue – d"; development of an expert system; data warehouse; associative rules. Forecasting. **Expected result:** to know: the theory of modern information technologies; methods, methods and means of obtaining, storing and processing information. 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 (professional-activity) competencies (PC 2): - 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	Analysis of the requirements for automated	Writing dissertations	**Content:** Having studied the discipline, undergraduates will know the paradigm of smart education: principles and technologies; Smart technologies of collective learning: joint

				information systems		formation of educational content and communication; open educational resources as the basis of smart education; development of a system of evaluation activities of an electronic 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); 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; own: the development of multimedia software, the use of various technologies in the development of multimedia tools. **Competencies:** 1. professional (professional-activity) competencies (PC 2): - 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:** 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; 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; possess: iterative-incremental software development cycle model, project planning and critical path, risk management in IT projects,

6					financial justification of the project, present value and payback, project configuration management. **Competencies:** 1. professional (professional-activity) competencies (PC 3): - 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; 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 (professional-activity) competencies (PC 3): - 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:** 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; 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 (professional-activity) competencies (PC 2): - 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 complementary parts. The first one tells about the methods of data storage in the infrastructures of a modern enterprise. Students receive information about the types of storage and the features of their application in classic and cloud environments of enterprises, learn about the architecture of solutions and basic algorithms underlying storage systems, and get an idea of SAN networks. The second part is devoted to the introduction to the problem of big data and the development of high-load services **Expected result:** know: IT architecture of a modern enterprise in terms of systems that provide storage and processing of large amounts of data, knowledge of algorithms and techniques for working with highly loaded services. 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. own: methods for developing high-load services. Acquisition of skills to work with

					modern big data processing libraries. **Competencies:** 1. professional (professional-activity) competencies (PC 2): - 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	The technology of object-oriented analysis and design	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, 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 (professional-activity) competencies (PC 3): - 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	The life cycle of software support	5	Analysis of the requirements for automated information systems	Writing dissertations	**Content:** Ways to use them. The software lifecycle is considered in several phases. The software lifecycle includes all stages of the software: accordingly, the solution of tasks for certain purposes is considered. Ways to use them. The software lifecycle is considered in several phases. The separation of the program cycle is considered in several ways. **Expected result:** know: LC software; ways to use LC software; principles and technology of program cycle separation; be able to: work with LC software; use LC software when solving problems; perform the separation of the program cycle,

					possess: develop automated information processing systems, databases using the stages and stages of program development, as well as perform software testing. **Competencies:** 1. professional (professional-activity) competencies (PC 3): - 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;
				16	

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

Form of education: Full-time
Studying term: 2 years   **Year of entry - 2023**

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			
Technology of object-oriented analysis and design	TOOAD5305	4	2
Analysis of requirements for automated information systems	ARAIS5305	4	2
Elective course 3			
Cryptographic Information Protection	CIP5306	4	2
Information security technologies	IST5306	4	2
Elective course 4			
Intelligent information systems and technologies	IIST6307	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
The life cycle of the software	LCS6310	5	3