# CATALOG OF ELECTIVE SUBJECTS

## «7M06102 – INFORMATION SYSTEMS»

| Module code | Module name | Discipline Code | Name of disciplines | Summary | Amount of credits ( KZ/ ECTS) | Semester | Prerequisites | Post-requirements | Expected results of studying the discipline |
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| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| **Basic disciplines** | | | | | | | | | |
| **Component of choice** | | | | | | | | | |
| M3 | Special | AMiPIS 5304 | Analysis modeling and design of IP | **The purpose of the discipline**: to study the methods of designing information systems based on international standards. **Course content:** Structure of various classes of information systems as design objects. Modern IP design technologies and methods of substantiating the effectiveness of their application. The content of the stages and stages of IP design and their features when using various design technologies. | 5/5 | 1 | Fundamentals of information systems, Design of information systems applications | Industrial practice, Experimental research work of a master's student | 1. **Knowledge acquired by students:** principles of choosing design solutions by types by types of information systems support. 2. **Skills acquired by students:** to implement and justify the choice of design solutions for the types of information systems support. 3. **Skills and competencies acquired by students:** selection of design solutions by types of information systems support; modeling and design of data structure and knowledge, applied and information processes. |
| M3 | Special | FTIT 5207 | Fundamental and topical issues of IT technology | **The purpose of studying the discipline:** mastering the theory, methods and technology of computer modeling in the study, design and application of information systems. **Course content:** Introduction. The Monte Carlo method. Simulation of random events. Modeling of continuous random variables. Modeling of discrete random variables. | 5/5 | 1 | Algorithms, data structures and programming, Fundamentals of | Intelligent systems, Java Script Application Development, Software Project Managementf | 1. **Knowledge acquired by students:** standard classes of models and methods of modeling complex systems, the apparatus of the Monte Carlo method, principles of constructing models of the processes of functioning of complex systems, methods of ormalization and algorithmization. |

| | | | | Modeling of multidimensional random variables. Modeling of random processes. Modeling of event flows. Identification of random patterns. Organization of computer modeling. Modeling of queuing systems. | | | information systems, Databases in IS | or IP development, IT Project Management | 2. **Skills acquired by students:** to use a systematic approach in the research, design and operation of information systems, to develop modeling algorithms and implement them using algorithmic languages and modeling application software packages, to automate the design process using modeling databases.<br><br>3. **Skills and competencies acquired by students:** the ability to apply a systematic approach to their own activities, choose standard methods and methods of performing professional tasks, evaluate their effectiveness and quality. |
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| M4 | Spe cial | MS 5208 | Mathematical statistics | **The purpose of the discipline** is to study the basic concepts, laws of probability theory and mathematical statistics and their applications in IT fields.<br><br>**Course content:** Elements of combinatorics. Probability. Properties of probability. TV theorems and formulas. A random variable. Random variable distribution laws and their characteristics. The law of large numbers. Correlation. General and sample populations. Methods of selection. Polygon and histogram. Statistical estimates. Variance. Confidence probability. Confidence intervals. Statistical hypotheses**.** | 5/5 | 1 | Algorithms , data structures and programmi ng, Fundament als of informatio n systems, Databases in IS | Data Analysis Tools, Information Retrieval, Big Data, Data Management | 1. **Knowledge acquired by students:** basic concepts of combinatorics, probability theory and mathematical statistics; basic concepts of graph theory; probabilistic models.<br>2. **Skills acquired by students:** to operate with the basic concepts of probability theory and mathematical statistics, to set mathematical problems, to build probabilistic models; to use calculation formulas, tables, graphs in solving statistical problems; to apply modern packages of applied programs of multidimensional statistical analysis; to calculate the probability of events using elements of combinatorics;<br>3. **Skills and competencies acquired by students:** setting a mathematical problem, building a probabilistic model, selecting suitable probabilistic methods and algorithms for solving problems; conducting statistical research. |
| M4 | Spe cial | OOPE 5208 | Objective - oriented programming in education | **The purpose of the discipline:** to study the main provisions of the information approach to the analysis and synthesis of objects, phenomena and systems; introduction to the information theory of measurements and | 5/5 | 1 | Algorithms , data structures and programmi | Data Analysis Tools, Information Retrieval, Big Data, Data | 1. **Knowledge acquired by students:** mathematical models of information processes; various approaches to assessing the amount of information; patterns of information processes in |

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| | | | | measuring devices, assimilation of its axiomatic provisions and methods of processing measurement results developed on their basis.<br><br>**Course content:** Subject, goals and objectives and objects of the course "Information Theory". The main stages of the development of information theory. Contribution of domestic and foreign scientists to the development of information theory. Features of the modern stage of information theory development. Information theory, computer science and information technology. The level of information culture of society. General and sample populations. Methods of selection. Polygon and histogram. Statistical estimates. Variance. Confidence probability. Confidence intervals. Statistical hypotheses. | | | ng, Fundamentals of information systems, Databases in IS | Management | physical and non-physical systems; graph theory; probabilistic models;<br>2. **Skills acquired by students:** methods for assessing the accuracy and quality of measurements using entropy values of measurement uncertainty; practical methods for determining the entropy value; measurement uncertainty based on both theoretical and experimental data;<br>3. **Skills and competencies acquired by students:** determination of quantitative characteristics of information processes; correct use of various types of information; determination of entropy value; measurement uncertainty; transition from information estimates of measurement accuracy to estimates based on the use of confidence intervals. |
| M4 | Special | CMIP 5209 | Cryptographic methods of information protection | **The purpose of studying the discipline:** gaining knowledge about the advantages of cryptographic information protection; understanding the mathematical foundations of cryptography; developing the ability to work with symmetric and existing asymmetric cryptographic algorithms.<br>**Course content:** Basic concepts of cryptography. The simplest methods of encryption with a private key. Principles of building block ciphers with a private key. DES and AES encryption algorithms. The algorithm of cryptographic data conversion GOST 28147-89. Cryptographic hash functions. Stream ciphers and pseudorandom number generators. | 5/5 | 2 | Algorithms, data structures and programming, Fundamentals of information systems | Intelligent systems, Java Script Application Development, Software Project Management for IP development, IT Project Management | 1. **Knowledge acquired by students:** mathematical foundations of cryptography; principles of symmetric and asymmetric cryptography; principles of electronic digital signature; principles of cryptanalysis.<br><br>2. **Skills acquired by students:** to choose crypto algorithms for solving specific tasks; to apply cryptography algorithms to protect information.<br><br>3. **Skills and competencies acquired by students:** to put into practice cryptographic algorithms for information protection. |
| M4 | Special | MPSE 5209 | Modern problems of science and education | **The purpose of studying the discipline:** principles of ensuring information security of the state, organization, individual citizen approaches to the analysis of its information infrastructure and solving problems of ensuring information security of computer systems.<br><br>**Course content:** International standards of information exchange. The concept of threat. Information security in the conditions of | 5/5 | 2 | Algorithms, data structures and programming, Fundamentals of information systems | Intelligent systems, Java Script Application Development, Software Project Management for IP development, | 1. **Knowledge acquired by students:** the role and place of information security in the national security system of the country; threats to the information security of the state, organization, citizen; modern approaches to building information security systems; computer system as an object of information impact, criteria for assessing its security and methods of ensuring its information |

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| | | | | functioning in global networks. Types of opponents or "violators". The main provisions of the theory of information security of information systems. Security models and their application. Taxonomy of computer system information security violations and the reasons for their existence. Analysis of ways of information security violations. The use of secure computer systems. Methods of cryptography. The place of information security of economic systems in the national security of the country. The concept of information security. | | | | IT Project Management | security. **2. Skills acquired by students**: to select and analyze quality indicators and criteria for evaluating systems and individual methods and means of information protection. **3. Skills and competencies acquired by students:** to use up-to-date scientific and technical information on the problems and tasks under study. |
| **Profile disciplines** | | | | | | | | | |
| **Component of choice** | | | | | | | | | |
| M3 | Spe cial | PW 5302 | PHP WEB programming | **The purpose of the discipline**: to study undergraduates the basics of object-oriented programming in C+; to teach students to identify and use abstract data types - classes; to use an object-oriented approach to program design; to create an idea of quality issues and motivation for the use of OOP. **Course content:** Basic concepts of cryptography. The simplest methods of encryption with a private key. Principles of building block ciphers with a private key. DES and AES encryption algorithms. The algorithm of cryptographic data conversion GOST 28147-89. Cryptographic hash functions. Stream ciphers and pseudorandom number generators. | 5/5 | 2 | Algorithms , data structures and programmi ng | Intelligent systems, Java Script Application Development, Software Project Management for IP development, IT Project Management | **1. Knowledge acquired by students:** basic principles of object-oriented programming; basic concepts of software engineering; syntax and purpose of the basic constructs of the C++ programming language. **2. Skills acquired by students:** to use basic methods and tools for developing algorithms; to competently design programs in C++ within the framework of procedural and object-oriented programming paradigms; to determine the criteria that the project should satisfy so that it can be easily maintained and modified; to use template classes of the standard C++ library (STL) and generalized algorithms when writing programs; apply design patterns. confidently create applications in fast development environments. **3. Skills and competencies acquired by students:** about the object-oriented programming paradigm; about inheritance as one of their effective tools for code reuse; about algorithmization; about the role of software design methods and tools. |
| M3 | Spe cial | HLPL 5302 | High-level programming | **The purpose of the discipline**: to study the general principles of the construction and use | 5/5 | 2 | Algorithms , data | Intelligent systems, Java | **1. Knowledge acquired by students:** general principles of construction and |

| M5 | Special | | languages | of modern programming languages; means of describing data and means of describing the actions of high-level programming languages. **Course content:** General principles of building and using programming languages. Data description tools. Means of describing actions. Abstract data types. Files. Handling exceptional situations. Debuggers. Code/application generators. Libraries of programs and classes. | | | structures and programming | Script Application Development, Software Project Management for IP development, IT Project Management | use of modern high-level programming languages; high-level programming language (object-oriented programming); 2. **Skills acquired by students:** to work with integrated software development environments; features of interaction of high and low-level languages, organization of work with data in scripting languages. 3. **Skills and competencies acquired by students:** web technologies studied in the process of programming in the PHP scripting language; the use of debugging tools and disassembly of program code. |
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| M5 | Special | DA 5303 | Data Analysis Tools | **The purpose of studying the discipline:** the study of special procedures used to collect, analyze and evaluate the quality of sociological data, packages of computer programs for data analysis (STATISTICA, SPSS). **Course content:** Theoretical and methodological foundations of data analysis in sociological research, tasks of data coding, formation and preparation of data tables. Methods and concepts of descriptive statistics (measures of dispersion and central trends, frequency tables, comparison of averages, correlation analysis, graphical representation of results. | 3/3 | 2 | Fundamentals of information systems, Mathematical statistics, Information Theory | Neural Networks, Machine Learning, Big Data, Data Management | 1. **Knowledge acquired by students:** basic statistical concepts and methods of data analysis. 2. **Skills acquired by students:** apply methods in practice. 3. **Skills and competencies acquired by students:** data preparation and analysis using statistical software packages (Statistica, SPSS). |
| M5 | Special | FSRIA 5303 | Fundamentals of scientific and research information activities | **The purpose of the discipline**: to study with the basic concepts of the theory of information retrieval, the basic principles of the organization of information retrieval systems and algorithms of analytical and synthetic processing of documents. **Course content:** Multilevel information model. Clarification of the terminology used. Computer science and Semiotics. General principles of the organization of information search engines. Metadata and processing of electronic resources. A model of an information search engine. The structure of the logical components of the information retrieval system. | 3/3 | 2 | Fundamentals of information systems, Mathematical statistics, Information Theory | Neural Networks, Machine Learning, Big Data, Data Management | 1. **Knowledge acquired by students:** fundamentals of the theory of information retrieval; basic principles of the organization of information retrieval systems; the main stages of analytical and synthetic processing of documents. 2. **Skills acquired by students:** to make a reasonable choice of technology for building an information search system; to practically implement the basic algorithms of information search. 3. **Skills and competencies acquired by students:** basic technologies for building information search systems; technologies for building thesauri and ontologies; |

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| | | | | | | | | | basic algorithms for analytical and synthetic processing of documents. |
| M6 | Special | IS 6304 | Intelligent systems | **The purpose of studying the discipline:** familiarization with the complex concepts of artificial intelligence systems, the main methods of their construction, obtaining practical skills in using methods and programming tools in the PDC Prolog language – the language of artificial intelligence systems.<br><br>**Course content:** Theoretical foundations of artificial intelligence systems. Systems of technical vision and image generation. Speech recognition and generation systems. Natural language interface systems. Expert systems. C programming languages. These tools.Prospects for the development of SII. | 5/5 | 3 | Fundamentals of information systems, Databases in IS, Analysis, modeling and design of IS | Research practice, Research work of a master's student | 1. **Knowledge acquired by students:** The theoretical foundations of SII, the principles of the construction and functioning of expert and training systems, natural language interface, pattern recognition and image generation, speech analysis and synthesis.<br><br>2. **Skills acquired by students:** to put into practice these tools, to program in the PDC Prolog language.<br><br>3. **Skills and competencies acquired by students:** logical programming technologies in the PDC Prolog language; ideas about logical methods of designing knowledge bases; has a culture of thinking, is capable of generalization, analysis, perception of information, setting goals and choosing ways to achieve it; willingness to use basic methods, methods and means of obtaining, storing, processing information, ready to work with a computer as an information management tool |
| M6 | Special | CAFD 6304 | Creating applications for mobile devices | **The purpose of studying the discipline:** is to master the basic concepts and principles of developing Internet applications and programming on the Internet.<br>**Course content:** Introduction and basic concepts of Internet applications. Technologies for creating Internet applications. JavaScript basics. Functions and objects in JavaScript. Creating scripts. The jQuery library. Working with audio and video streams. Internet broadcasts, compression and broadcast quality control. Automation of video processing, live video graphic design. Integration of video services into Internet | 5/5 | 3 | Fundamentals of information systems, Databases in IS, Analysis, modeling and design of IS | Research practice, Research work of a master's student | 1. **Knowledge acquired by students:** technologies for creating Internet projects; software for creating Internet applications; the subject area of Internet application development; prospects for the development of the subject area.<br><br>2. **Skills acquired by students:** development of Internet applications and websites; optimization of the structure of the website and files; preparation of text, graphic, video and audio content for |

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| | | | | projects. Project work and practice. Workflow management. Case studies. | | | | | websites; development of an advertising campaign project on the website; publication of the website on the Internet; creation of an online enterprise.<br><br>3. **Skills and competencies acquired by students:** technologies for technical processing of video streams, capturing video and audio signals; working with software to solve problems in the field of video preparation and technical processing of video, compression and transmission; broadcasting, recording and pre/post-processing of recordings, working with an archive of video materials.; apply the acquired knowledge and skills for solving problems in related fields. |
| M7 | Spe cial | MSPDI 6305 | Management of software projects for the development of IP | **The purpose of studying the discipline:** the use of a universal object-oriented modeling language UML within the framework of an object-oriented approach.<br><br>**Course content:** Introduction to the UML language. UML language tools for modeling systems. Semantics of the UML language. Object Constraint Language (OCL). Unified software development process. Object-oriented CASE systems. | 5/5 | 3 | Fundament als of informatio n systems, Databases in IS, Analysis, modeling and design of IS | Research practice, Research work of a master's student | 1. **Knowledge acquired by students**: Basic software design technologies; process-level decomposition-based design technologies; object-oriented analysis and design technologies; CASE-technologies.<br><br>2. **Skills acquired by students:** to conduct infological modeling; to design information systems.<br><br>3. **Skills and competencies acquired by students:** to possess the skills of CASE technology. |
| M7 | Spe cial | MCCS E 6305 | Modern concepts of computer science education | **The purpose of studying the discipline:** the formation of a systematic view of the complex tasks of project management in the field of information and communication technologies.<br><br>**Course content:** Introduction to IT Project Management; Initiation, Project Planning, Project Schedule Development, Quality Assurance Planning in the project, Project Risk Planning and Configuration Management in the project, Feasibility assessment and Project identification, Project Management in the development, implementation and operation phase. | 5/5 | 3 | Fundament als of informatio n systems, Databases in IS, Analysis, modeling and design of IS | Research practice, Research work of a master's student | 1. **Knowledge acquired by students:** principles of program-oriented and project-oriented management; modern project management methodologies based on international and national standards; specifics of project management.<br><br>2. **Skills acquired by students**: to determine the goals, subject area and structures of the project; to analyze the risks of the project; to select software tools for solving the main tasks of project management.<br><br>3. **Skills and competencies acquired by** |

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| | | | | | | | | | **students:** the use of modern methods and tools for project management. |
| M7 | Spe cial | CSN 6306 | Computer systems and networks | **The purpose of studying the discipline:** mastering the theoretical and practical foundations of the organization and functioning of computer networks, obtaining the basic skills necessary for designing computer networks, effective use and configuration of network equipment. **Course content:** Basic topology of computer networks. The concept of topology. Seven-level OSI model.Interaction of the OSI model levels. Standards and protocol stacks. Specifications of standards. Protocols and protocol stacks. The OSI stack. Architecture of the TCP/IP protocol stack. Physical data transmission medium. Network equipment. | 5/5 | 3 | Fundament als of informatio n systems, Databases in IS, Analysis, modeling and design of IS | Research practice, Research work of a master's student | 1. **Knowledge acquired by students:** network topology; protocols of interaction between the levels of the OSI model and their functions; setting up remote access to a computer using a modem; working with network operating systems. 2. **Skills acquired by students:** to choose and build a network architecture; to organize the interaction of the OSI model levels; to use standards and protocol stacks, transmission control protocol (TCP); to use LAN and LAN components, workstations, network adapters; to configure network equipment, network adapters and transceivers, NIC (Network Interface Card). 3. **Skills and competencies acquired by students:** use of Windows network OS families, UNIX OS kernel, file system. |
| M7 | Spe cial | ATE 6306 | Application of cloud technologies in education | **The purpose of studying the discipline:** mastering the theoretical and practical foundations of the organization and functioning of computer networks, obtaining the basic skills necessary for designing computer networks, effective use and configuration of network equipment. **Course content:** Basic topology of computer networks. The concept of topology. Seven-level OSI model.Interaction of the OSI model levels. Standards and protocol stacks. Specifications of standards. Protocols and protocol stacks. The OSI stack. Architecture of the TCP/IP protocol stack. Physical data transmission medium. Network equipment. | 5/5 | 3 | Fundament als of informatio n systems, Databases in IS, Analysis, modeling and design of IS | Research practice, Research work of a master's student | 1. **Knowledge acquired by students:** network topology; protocols of interaction between the levels of the OSI model and their functions; setting up remote access to a computer using a modem; working with network operating systems. 2. **Skills acquired by students:** to choose and build a network architecture; to organize the interaction of the OSI model levels; to use standards and protocol stacks, transmission control protocol (TCP); to use LAN and LAN components, workstations, network adapters; to configure network equipment, network adapters and transceivers, NIC (Network Interface Card). |

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| | | | | | | | | | 3. **Skills and competencies acquired by** students: use of Windows network OS families, UNIX OS kernel, file system. |
| M6 | Spe cial | MET 6307 | Modern educational technologies | **The purpose of studying the discipline:** the formation of skills and abilities of students to create mathematical models of processes and phenomena using neural networks, familiarity with control models based on systems using neural networks, the study of methods of formalization of processes and phenomena in the conceptual apparatus of neuromathematics. **Course content:** Introduction to neural networks Basic theorems of neuroinformatics. Basic concepts of the theory of neural networks. Formulation and ways of solving the problem of training neural networks. Standard neural network architectures. Associative memory neural networks. Neuro-fuzzy systems. | 6/6 | 3 | Fundament als of informatio n systems, Databases in IS, Analysis, modeling and design of IS | Research practice, Research work of a master's student | 1. **Knowledge acquired by students:** fundamentals of building models of artificial neural networks; basic concepts and definitions of non-classical logics; methods of setting operations on fuzzy numbers; on fuzzy relations. 2. **Skills acquired by students**: to build mathematical models in terms of neuromathematics; to solve applied problems by methods of neuromathematics. 3. **Skills and competencies acquired by students**: the language of fuzzy formal methods for solving applied problems. |
| M6 | Spe cial | DEEPR 6307 | Development and use of educational electronic publications and resources | **The purpose of the discipline:** to study the basics of the theory of machine learning, including discriminant, cluster and regression analysis, to master the skills of practical solving problems of data mining. **Course content:** Basic concepts and examples of applied tasks. Metric classification methods. Logical classification methods. Linear classification methods. Methods of regression analysis. Bayesian classification methods. | 6/6 | 3 | Fundament als of informatio n systems, Databases in IS, Analysis, modeling and design of IS | Research practice, Research work of a master's student | 1. **Knowledge acquired by students:** mathematical foundations of machine learning theory; the main classes of machine learning algorithms and their representatives and their interrelation, advantages and disadvantages. 2. **Skills acquired by students:** analyze, identify features and combine machine learning methods; apply machine learning methods to solve applied problems. 3. **Skills and competencies acquired by students:** software tools for developing machine learning algorithms, algorithms for building artificial neural networks; skills for developing machine learning models. |
| M5 | Spe cial | MMSR 6308 | Methodology and methodology of scientific research | **The purpose of studying the discipline:** fundamental training in the field of big data processing methods, mastery of big data processing tools. **Course content:** Big-Data. Tools. Technologies. Methods of analysis. Predictive modeling. The field of applied problems using | 3/3 | 3 | Fundament als of informatio n systems, Databases in IS, Analysis, | Research practice, Research work of a master's student | 1. **Knowledge acquired by students:** basic concepts of Big Data technology; basic concepts of forecasting; basic forecasting technologies. 2. **Skills acquired by students:** to identify arrays of big data; to analyze clusters of big data; to make various forecasts of the |

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| | | | | predictive modeling. The curse of dimensionality. Getting rid of useless and redundant input variables. Creation of training and verification data. A predictive model using a decision tree. Creating a decision tree: structure. The algorithm of construction. Search for partitions. A predictive model using a decision tree: building, creating a partitioning rule. Optimization of the complexity of decision trees. Evaluation of the quality of the decision tree. Predictive modeling: working with regression models. Regression. Logistic regression. Polynomial regressions. Evaluation of parameters. Processing of missing values. Selection of input variables. Optimization of complexity. Interpretation of regression. Regressions with transformed input variables. Predictive modeling: neural networks. Features of neural networks. Neural network training. Evaluation of models. Comparison of models. Statistics of model fitting. | | | modeling and design of IS | | development of socio-political processes.<br><br>3. **Skills and competencies acquired by students:** knowledge of modern technologies for creating and maintaining big data; methodology and methodology of forecasting. |
| M5 | Spe cial | DM 6308 | Data management | **The purpose of studying the discipline:** teaching the basics of organizing databases of computer networks, principles and methods of their protection, skills of complex design and construction, as well as to promote the formation of a scientific worldview and the development of systems thinking.<br><br>**Course content:** Basics of building databases. Database security tools. Physical implementation of database security. Data access rights management. | 3/3 | 3 | Fundament als of informatio n systems, Databases in IS, Analysis, modeling and design of IS | Research practice, Research work of a master's student | 1. **Knowledge acquired by students**: basic methods of data description and technology: analysis of information resources of the subject area; development of data models, design and maintenance of databases and their security.<br><br>2. **Skills acquired by students:** to design secure databases; to analyze the degree of database security and increase the level of protection, taking into account the development of mathematical and software computing systems; to use means of information integrity control, organization of DBMS interaction, database backup and recovery.<br><br>3. **Skills and competencies acquired by students:** carrying out measures for the design and maintenance of protected databases; organization and implementation of measures to ensure the safe processing of information on |

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1) Considered at the meeting of the Department of "Information Technology", protocol №___ from_____2023 year.

2) Discussed and recommended at the meeting of the academic committee of SBIT, protocol № ___ from _____2023 year.

**3) The catalog of elective disciplines is agreed upon:**

| № | Agreed with employers<br>(name of organization, position, full name) |
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| 1 | JSC "National Information Technologies", Chairman of the Board - Turysov A. |
| 2 | LLP "Kvarta LTD", Director - Andreev V. |
| 3 | IT integra LLP, Director of the branch - Ryabtsev D. |
| 4 | Agile Technologies LLP, Director - Zhilkibaev D. |

**Name head of the department** _____ E. Nuspekov
**Dean** _____ R.Aimkulov