Institute of Automation and Information Technology
Department of "Cybersecurity, information processing and Storage"

EDUCATIONAL PROGRAM
6B06103 – Information systems

Code and classification of the field of education: **6B06 Information and communication technologies.**
Code and classification of training directions: **6B061 Information systems**
Group of educational programs: **057 – Information technology**
Level based on NQF: 6
Level based on IQF: 6
Study period: 4
Amount of credits: 240

Almaty 2025

Educational program 6B06106 «Information systems» was approved at a meeting of the Academic Council of KazNTU named after K.I.Satpayev.

Protocol No _10__ of «__06__» __03___2025.

Reviewed and recommended for approval at a meeting of the Educational and Methodological Council of Kazntu named after K.I.Satpayev.

Protocol No. _3__ of «_20__» ___12___2024.

The educational program 6B06106 «Information systems" was developed by the academic committee in the direc

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List of abbreviations and designations

IS Information systems
ITP individual training plan
EP Educational program
NQF National qualifications framework
IQF Industry qualifications framework

1.Description of the educational program

The professional activity of graduates of the program is focused on the development and maintenance of information systems, namely the management of the development process. Information systems specialists will be trained according to the educational program "Information Systems". The content of the disciplines of the educational program has been developed taking into account the relevant educational programs of the world's leading universities and the international classifier of professional activity in the field of "Information Systems". Graduates of the educational program "Information Systems" are focused on the organization, design and development of systems. The program is designed to implement the principles of the democratic nature of education management, expand the boundaries of academic freedom and authority of educational institutions, which will ensure the training of qualified, highly motivated personnel for innovative and knowledge-intensive sectors of the economy within the framework of the ESG and the Sustainable Development Goals (SDGs).

The educational program ensures the application of an individual approach to students, the transformation of professional competencies from professional standards and qualifications standards into learning outcomes. Student–centered learning is provided - the principle of education, which involves shifting the emphasis in the educational process from teaching (as the main role of the teaching staff in the "translation" of knowledge) to teaching (as an active educational activity of the student).

The educational program provides training for specialists in the field of information systems in the following areas:

– development, implementation and operation of information retrieval systems;
– development, implementation and operation of information and analytical systems;
– development, implementation and operation of information management systems;
– development, implementation and operation of information and organizational systems.

The educational program was developed based on the analysis of labor functions, information systems specialists, stated in professional standards and the Atlas of Professions.

Representatives of Kazakhstani companies and associations, specialists in the field of software system development and support participated in the development of the educational program.

The tasks and content of the OP are given in section 9 "Description of disciplines".

In case of successful completion of the full bachelor's degree course, the graduate is awarded a bachelor's degree in information and communication technologies in the educational program "Information Systems".

2. The purpose and objectives of the educational program

Purpose of the EP:

High-quality training of specialists in the field of information systems, including software, hardware, information, legal and management support for the development and maintenance of information systems.

EP tasks:

- training of a competitive generation of information systems specialists for the labor market, proactive, able to work in a team, with high personal and professional competencies (SDG 4, 17).
- integration of educational and scientific activities; (SDG 4).
- Establishing partnerships with leading universities in the near and far abroad in order to improve the quality of education for sustainable development (SDGs 4, 17);

- expanding relations with customers of educational services and employers in order to determine the quality requirements for training specialists, conducting courses, seminars, master classes, internships, and production practices (SDG 4)

The content of the educational program "Information Systems" is implemented in accordance with the credit technology of education and is carried out in the state and Russian languages.

The educational program will make it possible to implement the principles of the Bologna process. Based on the students' choice and independent planning of the sequence of subjects, they independently form an individual study plan (IEP) for each semester according to the Working Curriculum and the Catalog of elective subjects. The volume of mathematical, natural science, basic and language subjects has been increased in the educational program.

Students complete internships in banking structures, government and departmental structures, in companies such as National Information Technologies JSC, the PARK of INNOVATIVE TECHNOLOGIES Special Economic Zone (SEZ PIT), Pacifica LLP, an integrator in the field of information systems, Galaktika LLP, Vella IT LLP, etc.

Under the academic mobility program, the best students have the opportunity to study at leading foreign universities in the relevant specialty.

The field of professional activity of the bachelor is public and private enterprises and organizations that develop, implement and use organizational, programmatic methods and means of information systems in all spheres of human activity that operate with information.

The subjects of the bachelor's professional activity are: mathematical, informational, technical, organizational support in the field of information systems.

Types of work activity:
- design and engineering;
- production and technological;
- experimental research;
- organizational and managerial;
- operational;
- scientific.

Objects of professional activity:
The objects of professional activity of graduates are:
- Computer information processing and management systems;
- Automated control systems;
- Information systems software.

3. Requirements for assessment of learning outcomes of the educational program

Mandatory standard requirements for graduation from a university and awarding an academic bachelor's degree: mastering at least 240 academic credits of theoretical studies and defending the final qualification (thesis or state examination in the specialty).

In the process of mastering the Information Systems educational program, a Bachelor of Engineering and Technology must possess the key competencies described in Section 4.11. The key competencies must reflect the results of the educational program described in Section 4.12.

4. Passport of the educational program

4.1. General information

№	Field name	Note
1	Code and classification of the field of education	6B06 - Information and communication technologies
2	Code and classification of training areas	6B061 Information systems
3	Group of educational programs	B057 Information technology
4	Name of the educational program	6B06103- Information systems
5	Brief description of the educational program	The professional activity of graduates of the program is focused on the development and maintenance of information systems, namely the management of the development process.
6	Purpose of the EP	High-quality training of specialists in the field of information systems, including software, hardware, information, legal and management support for the development and maintenance of information systems.
7	Type of EP	Updated EP
8	The level of the NRK	6
9	ORC Level	6
10	Distinctive features of the EP	The program trains specialists in three areas: DevOps Engineering, Business Analytics and IT Project Management, IP Architecture, and Business Application Development.
11	List of competencies of the educational program:	Fluent monolingual oral, written and communication skills, special mathematical thinking using induction and deduction, generalization and concretization, analysis and synthesis, classification and systematization, abstraction and analogy; understanding basic hypotheses, laws, methods, formulation of conclusions and error estimation
12	Learning outcomes of the educational program:	PO1. Make managerial and technical decisions, show sociability, initiative and psychological readiness for work, including when working in a team with people with special needs. Analyze data and develop innovative solutions for startups and sustainable information systems. Synthesize the acquired knowledge and evaluate the effectiveness of your projects in the context of real business situations. PO2. Apply knowledge about the basic principles and knowledge of mathematics, mechanics,

		physics. To carry out the proof of mathematical statements, solve mathematical problems and problems. Use the conceptual framework and methods of discrete mathematics to analyze mathematical models in solving professional tasks. PO3. Create algorithms for solving problems, develop software using modern programming languages of various levels, organize the necessary data structures, and use well-known application software packages. PO4. Analyze large amounts of data and apply statistical methods to extract meaningful information. Develop and evaluate distributed data processing systems for effective data management and analysis, including through artificial intelligence. PO5. Apply methods of computer and mathematical modeling, selection of optimal solutions, analysis and interpretation of data of various volumes and structures. PO6. To draw up technical specifications for the development of information systems for various purposes and different architectures using modern IT project management methods, as well as management principles within the framework of ESG and Sustainable Development Goals. Create an information model of the subject area for designing information support systems. PO7. Apply methods of computer modeling, selection of optimal solutions, analysis and interpretation of data of various volumes and structures. PO8. Design and develop ergonomic user interfaces for applications and websites. Synthesize data and create visualizations and reports that effectively convey information and support decision-making. PO9. Be proficient in written and oral communication in the state and foreign languages, establish professional contacts and develop professional communication for partnership in the interests of sustainable

		development. Analyze scientific sources and synthesize data for conducting research. PO10. To choose methods and means of building information security systems of modern ICT. PO11. Perform WEB layout, develop WEB and cross-platform mobile applications using modern technologies PO12. Describe the main financial and anti-corruption concepts. Apply the principles of budgeting, anti-corruption legislation, financial planning and sustainable development. Analyze the financial, legal, and ethical risks associated with corrupt practices. Analyze the relationship between environmental and economic factors, as well as assess the impact of business activities on the environment and the safety of life for responsible consumption of production PO13. Use modern management systems to build databases in an IP, represent data using various models, and manage database objects. To use methods of constructing various models of data types and algorithms for information processing, and to make rational use of the possibilities provided by algorithmization techniques PO14. Use virtualization and containerization technologies to deploy and manage IT infrastructure. Ensure the security and high availability of virtualized and containerized environments.
13	Form of training	Full-time
14	Duration of training	4-7 years old
15	Volume of loans	240
16	Languages of instruction	Kazakh, Russian, English (30%)
17	Academic degree awarded	Bachelor's Degree in Information and Communication Technology
18	Developer(s) and authors:	

4.2. Relationship between the achievability of the formed learning outcomes based on educational program and academic disciplines

№	Name of the discipline	Brief description of the discipline	Number of credits	Формируемые результаты обучения (коды)													
				PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14
	The cycle of general education subjects Required component																
1	Foreign language	English is a discipline of the general education cycle. After determining the level (according to the results of diagnostic testing or IELTS results), students are divided into groups and disciplines. The name of the discipline corresponds to the level of English language proficiency. When moving from level to level, the prerequisites and post-requirements of discipline are observed.	10	v								v					
2	Казахский (русский) язык	Рассматриваются общественно-политические, социально-культурные сферы коммуникации и функциональные стили современного казахского (русского) языка. Курс освещает специфику научного стиля с целью развития и активации профессионально-коммуникативных навыков и умений студентов. Курс позволяет студентам практически овладеть основами научного стиля и развивает умение производить структурно-семантический анализ текста.	10	v								v					

3	Physical Culture	The purpose of the discipline is the practical use of skills in performing the basic elements of athletics techniques, sports games, gymnastics and a set of standards for general physical training, including professionally applied physical training or one of the sports, methods of conducting independent physical exercises.	8	v									v				
4.	Information and communication technologies (in English)	Required component. The objective of studying the discipline is to acquire theoretical knowledge about information processes, new information technologies, local and global computer networks, information security methods; gain skills in using text editors and tabular processors; create databases and various categories of application programs.	5			v							v				
5	The history of Kazakhstan	The course examines historical events, phenomena, facts, and processes that took place in Kazakhstan from ancient times to the present day. The sections of the discipline include: introduction to the history of Kazakhstan; the steppe empire of the Turks; early feudal states on the territory of Kazakhstan; Kazakhstan during the Mongol conquest (XIII century); medieval states in the XIV-XV centuries. The main stages of the formation of the Kazakh statehood are also considered: the era of the Kazakh Khanate of the XV-XVIII centuries. Kazakhstan as part of the Russian	5														

		Empire; Kazakhstan during the period of civil conflict and in the conditions of a totalitarian system; Kazakhstan during the Great Patriotic War; Kazakhstan during the period of independence and at the present stage.																
6	Philosophy	Philosophy forms and develops critical and creative thinking, worldview and culture, provides knowledge about the most general and fundamental problems of existence and provides them with a methodology for solving various theoretical and practical issues. Philosophy expands the horizon of vision of the modern world, forms citizenship and patriotism, promotes self-esteem, awareness of the value of human existence. It teaches you how to think and act correctly, develops practical and cognitive skills, and helps you find ways to live in harmony with yourself, society, and the world around you.	5															
7	Module of socio-political knowledge (sociology, political science)	The discipline is designed to improve the quality of both general humanitarian and professional training of students. Knowledge in the field of sociology and political science is the key to effective professional activity of a future specialist, as well as for understanding political processes, forming a political culture, developing a personal position and a clearer understanding of the measure of their responsibility.	3															

8	Module of socio-political knowledge (cultural studies and psychology)	The module of socio-political knowledge (cultural studies, psychology) is designed to familiarize students with the cultural achievements of mankind, to understand and assimilate the basic forms and universal patterns of culture formation and development, to develop their aspirations and skills to independently comprehend the wealth of values of world culture for self-improvement and professional growth. During the cultural studies course, the student will consider the general problems of cultural theory, leading cultural concepts, universal patterns and mechanisms of culture formation and development, the main historical stages of the formation and development of Kazakh culture, its most important achievements. During the course, students acquire theoretical knowledge and practical skills, forming their professional orientation from the perspective of psychological aspects.	5														
	The cycle of general education subjects The university component																
1	The foundations of an anti-corruption culture	Purpose: to increase the public and individual legal awareness and legal culture of students, as well as to form a knowledge system and a civic position on combating corruption as an antisocial phenomenon. Content: improvement of socio-economic relations of the Kazakh society, psychological features of	5	**v**											**v**		

		corrupt behavior, formation of an anti-corruption culture, legal responsibility for acts of corruption in various fields.															
	Fundamentals of financial literacy	Objective: to increase public and individual legal awareness and legal culture Objective: the formation of financial literacy of students based on building a direct link between the knowledge gained and their practical application. Content: practical use of various financial management tools, saving and increasing savings, competent budget planning, obtaining practical skills in calculating and paying taxes and correctly completing tax reports, analyzing financial information and navigating financial products to choose an adequate investment strategy.		v											v		
2	Fundamentals of Economics and Entrepreneurship	Purpose: Formation of basic knowledge about economic processes and business skills. Content: The discipline is studied in order to develop skills in analyzing economic concepts such as supply and demand, market equilibrium. The basics of business creation and management, development of business plans, risk assessment and strategic decision-making are included.	5	v											v		
3	Ecology and life safety	The discipline studies the tasks of ecology as a science, ecological terms, laws of the functioning of natural systems and aspects of environmental safety in working conditions. Environmental monitoring and	5	v											v		

		management in the field of its safety. Sources of pollution of atmospheric air, surface, groundwater, soil and ways to solve environmental problems; safety of life in the technosphere; natural and man-made emergencies															
	The cycle of basic disciplines The university component																
1	Mathematics I	The course is designed to explore the basic concepts of higher mathematics and its applications. The main provisions of the discipline are used in the study of all general engineering and special disciplines taught by graduate departments. The course sections include elements of linear algebra and analytical geometry, an introduction to analysis, and differential calculus of functions of one and several variables. The issues of methods for solving systems of equations and the application of vector calculus to solving problems in geometry, mechanics, and physics are considered. Analytical geometry on a plane and in space, differential calculus of functions of one variable, derivative and differentials, study of the behavior of functions, Directional derivative and gradient, extremum of a function of several variables.	5		**v**			**v**									
2	Physics	Purpose: to form ideas about the modern physical worldview and scientific worldview, the ability to use	5		**v**					**v**							

		knowledge of fundamental laws, theories of classical and modern physics. Contents: physical foundations of mechanics, fundamentals of molecular physics and thermodynamics, electricity and magnetism, vibrations and waves, optics and fundamentals of quantum physics															
3	Mathematics II	Purpose: To teach students integration methods. To teach you how to choose the right method for finding the original. To teach how to apply a certain integral to solve practical problems. Contents: integral calculus of a function of one and two variables, theory of series. Indefinite integrals and methods of their calculation. Certain integrals and applications of certain integrals. Improper integrals. Theory of numerical and functional series, Taylor and Maclaurin series, application of series to approximate calculations.	5		v			v									
5	Discrete mathematics	The discipline covers coding theory, set theory, graph theory, and mathematical logic. Namely, the basics of coding theory, set theory, graph theory; the theory of logic algebra; the mathematical apparatus of synthesis and analysis of digital devices, convert Boolean functions, synthesize minimal combination schemes; perform coding.	5		v			v									

7	Fundamentals of information systems	The purpose of studying the discipline is to master the basic concepts of information, data, systems, classifications of systems; solved problems in IP; principles of building and functioning of information systems and classification of IP.	4						v								
8	Algorithmization and programming basics	Purpose: To master the basics of algorithmization and programming to solve typical problems using modern programming languages. Contents: Basic concepts of algorithmization, structural programming, basic algorithms and data structures, syntax and semantics of the chosen programming language, software debugging and testing methods, algorithm development and analysis, examples of solving real-world problems.	5			v			v								
9	Algorithms and data structures	The course covers the main approaches to the analysis and design of algorithms and data structures. The course covers topics such as asymptotic estimation of algorithm complexity in the worst case, efficient algorithms for sorting and selecting ordinal statistics, data structures (binary search trees, heaps, hash tables), algorithm design methods (divide and conquer, dynamic programming, greedy strategy), basic graph algorithms (shortest paths,	5				v		v								

		topological sorting, connectivity components, minimum spanning trees).															
10	web programming	The course is devoted to the study of programming sections focused on the development of web applications. The objectives of the discipline are to become familiar with the principles and methods of web page layout and layout, to study modern web application development environments, to acquire client-side and server-side programming skills, and to acquire theoretical and practical skills in creating web applications.	5			v								v			
11	Databases and SQL language	The course "Databases and SQL Language" focuses on teaching students the skills of data extraction using the SQL language. Students learn various types of queries, including table joins, conditional statements, aggregate functions, and many other concepts to get the information they need from databases. Special attention is paid to query optimization to improve the efficiency of data search and processing. Upon completion of the course, students will master the data management skills needed to solve a wide range of tasks in the field of analytics and software development.	6						v							v	
12	Object-oriented programming	The course covers such topics as: the paradigm of object-oriented programming; classes and objects;	5			v			v								

		principles of creating scalable software using a high-level method of designing business environment concepts in a programming language; programming languages C++, Java and C#; principles of abstractions, encapsulation, inheritance, polymorphism; software design patterns; practical skills creation of software products.															
13	Fundamentals of cybersecurity	Purpose: to study the key aspects of protecting information systems and networks from various types of threats, including software attacks, malware, phishing, insider threats, and others. Contents: Introduction. Principles of cybersecurity. Data encryption. Access control. Security audit. Developing security policies and responding to incidents. Legal and ethical aspects in the field of cybersecurity, regulating the use of information technologies.	5							**v**			**v**				**v**
14	Computer networks	The program of the training course is aimed at familiarizing students with the basics of organization, construction, architecture and principles of functioning of computer networks. The course focuses on the application of skills to organize the work of real networks and examines communication tools, protocols and standards of networks. As a result of mastering the discipline, students will learn how to configure and configure communication	5							**v**							**v**

		tools, select firewalls, and operate computer networks.															
15	Operating systems	The purpose of studying the discipline is to acquire the primary skills necessary to study system programming and operating system administration, including the skills of configuring and analyzing operating systems. Special attention will be paid to the three main subsystems of the operating systems: process management (processes, threads, CPU scheduling, synchronization, and deadlocks), memory management (segmentation, pagination, paging), file systems, and operating system support for distributed systems.	5							v			v				v
16	Database administration	The purpose of this discipline is to be responsible for developing database requirements, its design, implementation, effective use and maintenance, including managing database user accounts and protecting against unauthorized access. An equally important function of the database administrator is to maintain database integrity.	5				v		v							v	
17	Integration of information systems	The purpose of the Information Systems Integration course is to teach students the basics of combining various information systems into a single structure. Students will learn about integration strategies, technical aspects of system collaboration, and data exchange methods. The main focus is on	5			v			v								

		developing skills in requirements analysis, design and implementation of integration solutions.																
18	Statistics and data analysis	Applied statistics is a methodological discipline that is the center of statistics. When applying the methods of applied statistics to specific fields of knowledge and branches of the national economy, scientific and practical disciplines such as "statistics in industry", "statistics in medicine", "statistics in psychology", etc. are obtained. From this point of view, econometrics is "statistical methods in economics." Mathematical statistics plays the role of a mathematical foundation for applied statistics.	4				v	v										
19	IT project management	The purpose of mastering the discipline is to form the professional competencies of students in effective project management, including through the use of project management information systems. The course covers the following issues: basic methods and tools of computer-aided design; modern standards and methods of project management; principles of standardization in the field of project management; purpose, functions and examples of project data management systems.	6	v					v									
20	Inclusive education	The purpose of the discipline: to give students an idea of the foreign and domestic learning experience based on	5	v														

		an ideology that excludes any discrimination; on the development and implementation of conditions that ensure equal treatment of all people and the need for special conditions with special educational needs; to introduce the principles of inclusive education; with the organization of inclusive education in educational institutions.																
	The selection component																	
21	Continuous CI/CD integration and deployment	The aim of the CI/CD Continuous Integration and Deployment course is to teach students modern methods and tools for automating software development, testing, and deployment processes. Students will learn the principles of building continuous integration and deployment of CI/CD pipelines, as well as methods and tools for automating code testing. The focus is on developing skills for working with tools such as Jenkins, GitLab CI, Travis CI, and others.	5			**v**			**v**									
22	Business process analysis	The purpose of studying the discipline is the analysis of business processes "as is" based on BPMN and UML notations, including the description of business processes, digitization of process benefits, processing and analysis of data used in the process using the example of real business processes; identification of bottlenecks of business processes based on data mapping in order to development of recommendations on	5						**v**	v								

		reengineering, improvement and optimization of business processes.															
23	Mathematics III	Purpose: To teach students integration methods. To teach you how to choose the right method for finding the original. The discipline is a continuation of Mathematics II. The course includes sections: ordinary differential equations and elements of probability theory and mathematical statistics. Differential equations with separable variables, homogeneous, in full differentials, linear inhomogeneous differential equations with constant coefficients, systems of linear differential equations with constant coefficients, finding the probability of events are studied.; calculation of numerical characteristics of random variables; the use of statistical methods for processing experimental data.	5		v			v									
24	Design patterns	The purpose of studying the discipline is to study the main types of design patterns (generative, structural, behavioral); the most common patterns, their advantages and disadvantages, criteria for the applicability of patterns in specific situations.	5			v			v								
25	Query language and report development	The discipline is designed for students who are familiar with the object model of the embedded language of the 1C platform.:Company. As a result, students should gain skills in working with a tabular model, as well as skills for	5								v					v	

		working with analytical queries. Within the framework of the discipline, all the basic query language mechanisms of the 1C platform are considered.:Enterprises															
26	Design thinking	Objective: To provide students with knowledge and skills in design thinking to solve complex problems, innovate design, and develop creative ideas. Content: Learning the basic concepts of design thinking, including problem identification, user needs research, idea generation, prototyping, and solution testing.	4	v								v					
27	Business process modeling	The purpose of the course is to develop students' skills in modeling and analyzing business processes in order to solve applied problems. The content of the discipline includes questions about the system, process-oriented approach to business management, methodologies and models, tools for modeling and analyzing business processes and managing complex systems.	5					v	v								
28	Development of an IS prototype	The purpose of mastering the discipline is to gain practical skills in creating information systems based on the 1C platform.:Enterprise 8, as well as master the query language and data layout mechanism at the initial level, acquire basic programming skills to solve accounting problems.	5						v	v						v	
29	Capstone project 2	The course is aimed at studying and developing students' understanding of the process of attracting investments and	5	v					v			v					

		scaling a business; developing practical skills in the field of attracting investments in a startup. During the course of the discipline, students consider the following issues: searching and identifying various sources of financing and selecting potential investors for a business; applying to accelerators; preparing investment documentation; creating investment presentations; presenting a project to a potential investor.															
30	Optimization methods and operation research	The purpose of teaching the discipline "Optimization Methods and Operations Research" is to study the basics of system analysis, operations research and decision making using models and methods including linear, integer and quadratic programming, dual evaluation, optimization models of production and resource allocation, network optimization, game theory. Tasks of studying the discipline As a result of studying the discipline, students must: 1. to know the state of the subject, its methodology, significance for practice, and development prospects; 2. be able to build a model of a system or an operation performed by it, set a research task, apply mathematical methods and computational tools to obtain the desired results, analyze the specified results; 3. have the skills to study a certain operation as a whole, as well as quantify	5		v			v									

		the optimal solution to the operation management problem.															
31	Fundamentals of sustainable development and ESG projects in Kazakhstan	Objective: students to master the theoretical foundations and practical skills in the field of sustainable development and ESG, as well as to form an understanding of the role of these aspects in the modern economic and social development of Kazakhstan. Content: introduces the principles of sustainable development and the implementation of ESG practices in Kazakhstan, includes the study of national and international standards, the analysis of successful ESG projects and strategies for their implementation in enterprises and organizations.	5									v			v		
32	Databases and web service development	The discipline "Databases and Web Service Development" focuses on the interaction of databases with web services. Students learn how to design databases for data storage, as well as how to integrate these databases into web services for data exchange with client applications. The course includes learning the concepts of working with databases through the Web Services API, data access methods, and query processing. Upon completion of the course, students will have the skills to develop and integrate web services with databases to ensure effective interaction between various application components.	5											v		v	

33	Fundamentals of students' research work	The course is aimed at forming a comprehensive understanding of the specifics of scientific research; mastering research methods that are most relevant to the subject of research; acquiring skills and abilities for independent research activities. The course content includes the basic concepts and classification of science and scientific information: its sources and methods of processing; types and forms of educational research and research work of university students. The requirements for the technical design of scientific work are considered.	5	v								v					
34	The basics of artificial intelligence	Purpose: to familiarize students with the basic concepts, methods and technologies in the field of artificial intelligence: machine learning, computer vision, natural language processing, etc. Contents: general definition of artificial intelligence, intelligent agents, information retrieval and state space exploration, logical agents, architecture of artificial intelligence systems, expert systems, observational learning, statistical learning methods, probabilistic processing of linguistic information, semantic models, natural language processing systems.	5				v	v									
35	Capstone project 1	The purpose of the course is to apply project management techniques, ways to transform ideas into a specific solution, and determine the most optimal	5	v					v			v					

		approach to its implementation. Course participants will gain a holistic understanding of the process, key techniques, and tools needed to design, develop, and further develop their products and services.															
36	Devops engineering	The course is aimed at studying the methodology of building, configuring, deploying software and quickly releasing software product versions. The content of the discipline includes issues related to the organization of continuous integration, deployment and software delivery processes within the framework of the DevOps paradigm. Modern technologies for automating the development process are being studied - Docker, Docker-Compose, Jenkins. Examples of using technologies for projects of various specifics are considered.	5	v					v								
37	Startups and technological entrepreneurship	The purpose of studying the discipline is to develop theoretical knowledge and practical skills in the field of technological entrepreneurship and management of innovative projects, namely their development, implementation and implementation. The course contains practical elements such as developing business models, conducting market research, implementing product development cycles, and raising seed capital.	5	v								v					

38	Communication skills	The aim of the course is to increase the level of language competence of students in accordance with the academic and professional needs of future specialists. The aim of the course is to develop communication skills, instill business correspondence and oral presentation skills in the context of advanced business English. During the semester, students will work as a team on a professionally oriented project, which may include creating a company project and exploring a given problematic situation.	4	v								v					
39	Architecture of information systems	The aim of the course is to provide students with systematic knowledge in the field of computer architecture and information system architectures (IS). The content of the discipline includes the classification of IP architecture, principles of IP construction, models and resources of information systems, the main components of information systems that are of fundamental importance for the system as a whole. During the course, students will apply information system architecture development tools and information system development tools.	5						v								v	
40	Legal regulation of intellectual property	Objective: to form a holistic view of the system of legal regulation of intellectual property, including the basic principles, mechanisms for the protection of intellectual property rights and the	5	v												v		

		specifics of their implementation. Content: The discipline covers the fundamentals of IP law, including copyright, patents, trademarks, and industrial designs. Students learn how to protect and manage intellectual property rights, as well as consider legal disputes and how to resolve them. DB															
	The cycle of profile disciplines The university component																
41	Artificial intelligence and machine learning	The purpose of the discipline is to prepare students for the application of MO methods in various fields such as computer vision, natural language processing, recommendation systems, medicine and finance. The course provides an introduction to the basic concepts, methods, and applications of artificial intelligence (AI) and machine learning (MO). During the course, students learn various MO algorithms such as linear regression, the support vector method, decision trees, neural networks, and data clustering. They also learn about data-driven learning theory, data preprocessing techniques, model evaluation, and optimization techniques. The course includes both theoretical foundations and practical tasks, including working with real data and MO tools such as TensorFlow, scikit-learn and PyTorch.	6				v									v	v
42	IT infrastructure	The purpose of studying the discipline: to	5						v	v							

		form a knowledge system about modern technologies, methods and tools used to manage the infrastructure of the enterprise and optimize the functioning of the department. The course covers all the main areas of activity of specialists who ensure the management and optimization of the functioning of the enterprise's IT infrastructure and includes: the development of enterprise architecture, modern concepts of audit (CobiT) and enterprise IT infrastructure management (ITIL, ITSM), methods for organizing the development and support of software and hardware.																
43	Development of an IP business specification	The purpose of mastering the discipline is to identify, analyze and formalize the functional and non-functional requirements of the customer in order to develop a business specification for creating an information system. The course covers the development of an IP specification, the formulation of requirements, the analysis of requirements, and the formalization of information system requirements	5						v								v	
44	UI/UX design	This course focuses on User Interface and User Experience design, two key components of a digital product. It is their interaction that shapes the user experience and influences the perception of the product. In this course, you will learn the tools and methodologies needed to create a functional, user-friendly, and attractive interface.	5						v		v							
45	The basics of cloud computing	The course is aimed at studying the theoretical foundations of cloud computing, the internal structure and practical implementation, and applied examples of cloud computing and web services. During	5									v						v

		the course of studying the discipline, students will consider the main classes of cloud systems, the main standards in the field of cloud computing, web technologies and web services, the principles of using cloud computing to solve applied problems and build web services and cloud systems.															
46	Development of cross-platform mobile applications	The aim of the course is to train students to create high-quality cross-platform mobile applications with minimal time and resources. During the course, students will learn how to create mobile applications that can run on different operating systems (for example, iOS and Android) using the same code. In addition, they study tools and technologies such as React Native, Flutter or Xamarin, which allow developers to create mobile applications using knowledge of web development or other programming languages such as JavaScript, Dart or C#. The course includes both theoretical foundations and practical tasks, including prototyping, user interface creation, data management, and application testing.	5			v					v			v			
47	Programming in T-SQL	Learning the basics of the T-SQL language and its application in Microsoft SQL Server. Students learn the language elements of T-SQL, as well as the creation of stored procedures and functions for efficient database work. The course also includes error handling, transaction creation and management.	5		v											v	
48	Distributed data processing systems	The purpose of the course is to teach students the principles and tools used to process large amounts of data in a distributed environment. Students study the concepts of parallel computing, distributed	5				v		v	v						v	

		systems architecture, and data processing tools such as Apache Hadoop and Apache Spark to efficiently analyze, process, and manage data in modern information systems.															
49	Developing technologies in information systems	The purpose of the discipline is to study emerging new technologies and to study their impact on business and social issues from the point of view of business and theory. Students learn to understand the concepts of new technologies, which are defined and evaluated based on a number of business requirements based on various ethical and environmental aspects, and sustainable development perspectives. Technology is applied in practice to provide suitable business opportunities.	5						v						v	v	
50	VBA Business Modeling	VBA Business Modeling teaches students how to create and analyze business models using the VBA programming language, including working with data and automating business processes in Excel.	5	v		v									v		
51	System design	The purpose of the System Design course is to teach students the principles, methods, and tools for designing complex information systems and architectural solutions. Students learn the basics of requirements analysis, business process modeling, and creating high-level architectural concepts. The focus is on developing systems thinking skills, the ability to take into account various aspects of design, such as performance, scalability, security, and usability.	5	v				v									
52	Data visualization and reporting	The purpose of the course is to develop skills in graphical representation of data, to understand, explain and determine the laws of formation from this data. The content of	5								v	v					v

		the discipline examines issues related to the collection, processing, analysis and visualization of data for solving professional tasks using modern information and communication technologies. A set of methods that allow the use of visual representation for the study, analysis and communication of quantitative data is considered.															
53	IT audit and control	The course is aimed at studying the basic concepts and concepts of information systems audit. In the course of studying, students will consider the stages and principles of conducting an IT audit to gain practical skills, the risks inherent in key IT processes and control procedures to reduce them (IT controls). They will also gain the necessary experience in drafting working documents and master the principles of evaluating the internal control system in OT.	5							v			v		v		
54	Development of IS for trade automation	The purpose of mastering the discipline is to gain skills in configuring operational accounting tasks on the 1C: Enterprise 8 platform. As a result, students should learn how to apply a scheme for solving operational tasks, use different ways to write data to registers and read from them, develop algorithms for reflecting documents in accounting, and develop analytical reports.	5						v		v				v		
55	Development of IS for financial accounting	Gain practical skills in configuring accounting tasks. As a result of the training, students will learn how to independently design a chart of accounts	5						v		v				v		

		and an accounting register to solve the problems of synthetic, multi-company, analytical, quantitative and currency accounting.															
56	Virtualization and containerization systems	The purpose of the training course is to familiarize students with the specifics of virtualization of information structures and the formation of skills in working with software systems for virtualization. During the course of studying the discipline, students will acquire knowledge about virtualization technologies, implementation levels, and the necessary hardware and software. To study devices and solutions in the field of container virtualization. Students will acquire skills in configuring hypervisors, monitoring and administering virtual infrastructures.	5				v										v
57	Programming in PL/SQL	The purpose of mastering the discipline is to study the Oracle PL/SQL procedural language. As a result, students will learn how to create, modify, and delete stored PL/SQL objects, handle exceptions, use dynamic SQL, and work with object types and collections.	5			v											v	
58	Business process automation	The purpose of mastering the discipline is to automate business processes from idea to implementation. The course content includes the development of business process atomization based on the identification and analysis of stakeholders' requirements, business	5						v		v							

		process automation specifications, business process models, data mapping, and "TO BE" automated business process solution requirements															
59	Digital transformation technologies	The purpose of the training course is to form a comprehensive vision of the fundamentals of digital transformation: from technological trends, new business models, data-based management, to the necessary transformation of the organizational structure, corporate culture and business processes of the enterprise. The course is dedicated to discussing changes in companies that occur under the influence of emerging new information technologies. The article examines the changing business environment, the emergence of new models and scenarios in the modern environment, the impact of the evolution of digital technologies on the personnel of companies, and the changing nature of competition.	5							v						v	v

5. The curriculum of the educational program

Note:

1. The module of basic training and professional activity of the department prescribes the names of the modules and their number.
2. Division into types of work at the discretion of the department
3. If necessary, the disciplines: Physics II, Mathematics III, General Chemistry of the department are included at the expense of credits of the component of the Department of DB, VC from the basic training module
4. The full academic load of one academic year should be 60 academic credits
5. The application of the catalog of elective subjects is the same as the Curriculum is divided into modules, with the inclusion of the Module "R&D"

Changes:

The discipline "Inclusive Education" has been added , R1, R4, R6, R9, R12 have been reformulated, taking into account the Sustainable Development Goals