



CATALOG OF ELECTIVE DISCIPLINES

For students in the direction of preparation GB61 «Information and communication technologies»

Brief description of the elective disciplines of the educational program

EPG	EP	Form of education	The name of discipline	Code of subject	Discipline cycle	Component of subjects	Number of credits	Level of training	Cafedra	Courses	Academic period	Pre-requisites	Post-requisites	Brief content of the discipline	Key learning outcomes	Name of the alternative discipline
B057 - «Information technology»	GB06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Basics of anti-corruption culture	OAK 2119	GER	Elective subjects	5.0	Bachelor	Economy	2	1	History of Kazakhstan, Political science and sociology	Cybersecurity, Firewall, IT Management Methodology, IT project management and entrepreneurship	The discipline examines the theoretical and methodological foundations of the concept of "corruption" and examines the improvement of socio-economic relations of the Kazakh society as a condition for combating corruption, psychological features of the nature of corrupt behavior, formation of anti-corruption culture, features of formation of anti-corruption culture of youth, ethnic features of formation of anti-corruption culture, moral and ethical responsibility for corruption in various spheres. Discipline allows you to learn about legal responsibility for corruption offenses	Analyze in a logical and quantitative way the conditions for the development of production and evaluate the competitiveness of created products on the principles of engineering, study innovative entrepreneurship and anti-corruption culture, formulate inventions	Basics of economics and law, Ecology and life safety fundamentals, Leadership and team management, Technological entrepreneurship
B057 - «Information technology»	GB06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Basics of anti-corruption law	OEP 2125	GER	Elective subjects	5.0	Bachelor	Economy	2	1	History of Kazakhstan, Political science and sociology	Cybersecurity, Firewall, IT Management Methodology, IT project management and entrepreneurship	The discipline promotes knowledge of the subject of economic theory and methods of research, the basis of public production and forms of public economy, the mechanism of functioning of the market system, production, costs and income of the firm, national economy. Give an assessment of economic growth and instability of the market economy, inflation and unemployment as manifestations of economic instability. Demonstrate knowledge and skills in the financial and monetary credit system in the national economy and economic security. To master the basics of the theory of the state and law, the basics of constitutional, administrative, civil, labor, family, criminal law.	Analyze in a logical and quantitative way the conditions for the development of production and evaluate the competitiveness of created products on the principles of engineering, study innovative entrepreneurship and anti-corruption culture, formulate inventions	Basics of anti-corruption culture, Ecology and life safety fundamentals, Leadership and team management, Technological entrepreneurship
B057 - «Information technology»	GB06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Technological entrepreneurship	TP 2126	GER	Elective subjects	5.0	Bachelor	Computer science	2	1	Cultural studies and psychology, Information and communication technologies	Introduction to BIG DATA Technology, IT Management Methodology, IT project management and entrepreneurship	Study modern concepts and tools of entrepreneurship and gain theoretical knowledge and practical skills necessary to launch your own startups. Reveal ideas about modern trends in innovative development, analyze and assess the risks of innovative start-up projects. Idea. Startup team. The target audience. Value proposition. Customer development. Customer discovery. Estimating the size of the market (minimum viable product). Marketing funnel. Promotion tools: how to attract first users. Investments. Sources of investments. Preparing a pitch for investors. Innovation systems and clusters. Corporate networks and technology alliances in the innovation process.	Have an idea about the basics of the economy, anti-corruption culture, ecology, life safety and the main provisions of the current legislation of the Republic of Kazakhstan. To use professional knowledge and skills in entrepreneurial activity, in management role and for solving problems in innovative projects and research being developed.	Basics of anti-corruption culture, Basics of economics and law, Ecology and life safety fundamentals, Leadership and team management
B057 - «Information technology»	GB06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Ecology and life safety fundamentals	EOBZ2h 2127	GER	Elective subjects	5.0	Bachelor	Ecology	2	1	Cultural studies and psychology, Political science and sociology	Basics of Green Networking, IoT Technology, IT Management Methodology, IT project management and entrepreneurship, Networking and System Administration	The laws of ecology, as a theoretical basis for nature conservation and rational natural resource management, the relationship of organisms with environmental factors and habitat conditions, the anthroposphere concept of V.I. Vernadsky, concepts and concepts of sustainable development.	To be able to analyze the influence of environmental factors on the vital activity of living organisms and the environment; Possess the basis of economic and legal knowledge in the forestry sector, know and understand the goals and methods of state regulation of the economy. Evaluate and integrate the basic theories of motivation, leadership and power to solve strategic and operational management tasks, understand the importance of the principles and culture of academic integrity and anti-corruption culture.	Basics of anti-corruption culture, Basics of economics and law, Leadership and team management, Technological entrepreneurship
B057 - «Information technology»	GB06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Leadership and team management	LUK 2128	GER	Elective subjects	5.0	Bachelor	Management and marketing	2	1	Cultural studies and psychology, Kazakh (russian) language	IT Management Methodology, IT project management and entrepreneurship	The function of a leader in modern society. The history of the birth and development of leadership psychology. Personal characteristics of the leader. The concept of the team, types of teams. Forming effective teams. Team management. Socio-psychological structure of the team. Team management problems. Peculiarities of behavior in a group: group thinking and group pressure as a means of influencing its participants.	Recognize the importance of personal career development based on improving professional level and features of management and marketing activities. Develop innovative and investment projects on the basis of standard methods, taking into account the current legal acts to attract investments in conditions of risk and uncertainty of the market economy.	Basics of anti-corruption culture, Basics of economics and law, Ecology and life safety fundamentals, Technological entrepreneurship

B057 - «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Design Database Oracle I	PBO 2203	BS	Elective subjects	5.0	Bachelor	Computer science	2	Algorithms and data structures I, Information technologies, Mathematical foundation of information technologies	CI application development II, Design Database Oracle II, Development of software applications by Python tools II, Geoinformation technologies in agriculture, Intelligent systems in agriculture, IT Management Methodology, IT project management and entrepreneurship, Java application development II, Neural networks, Pattern recognition	Definitions of concepts: database, DBMS, applications. Database life cycle. Stages of database design. Logical model, Infological modeling, ER-model. Design method "Entity-Relationship". Relational data model: definitions of concepts, relations properties, relations types. Architecture DBMS Oracle. Relational database design. Using SQL *Plus. Oracle database Internal structures. Data Definition Language (DDL). Implementation of the physical scheme.	Apply the basics of scientific research methods and written scientific communication necessary for communication in a professional academic environment. Freely use written communication techniques to perform academic work, freely express ideas on the problem under study. Adhere to the principles and culture of academic integrity. Analyze tasks, determine solutions and select efficient algorithms for task implementation. Define input and output data. Understand the integrity of the developing software. Pick a language and programming tools to it. Develop applications with a database, web portals, separate modules for them, integrate modules into applications. Describe the model and stages of database design, apply database normalization, use modern database control systems, integrate them into applications, control and design databases, create queries to search for data according to various criteria, delete and add data, determine the data relevance in software/hardware. Database design and integrity maintenance, normalization.	Designing SQL Database I
B057 - «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Designing SQL Database I	PBS 2255	BS	Elective subjects	5.0	Bachelor	Computer science	2	Algorithms and data structures I, Information technologies, Mathematical foundation of information technologies	CI application development II, Designing SQL Database II, Development of software applications by Python tools II, Geoinformation technologies in agriculture, Intelligent systems in agriculture, IT Management Methodology, IT project management and entrepreneurship, Java application development II, Neural networks, Pattern recognition	Definitions of concepts: database, DBMS, applications. Database life cycle. Stages of database design. Logical model, Infological modeling, ER-model. Design method "Entity-Relationship". Relational data model: definitions of concepts, relations properties, relations types. Ensuring data integrity. Candidate key, foreign key, NULL values, DDL language. Normalization theory. Normal forms, SQL query language. Relational Algebra Operations	Apply the basics of scientific research methods and written scientific communication necessary for communication in a professional academic environment. Freely use written communication techniques to perform academic work, freely express ideas on the problem under study. Adhere to the principles and culture of academic integrity. Analyze tasks, determine solutions and select efficient algorithms for task implementation. Define input and output data. Understand the integrity of the developing software. Pick a language and programming tools to it. Develop applications with a database, web portals, separate modules for them, integrate modules into applications. Describe the model and stages of database design, apply database normalization, use modern database control systems, integrate them into applications, control and design databases, create queries to search for data according to various criteria, delete and add data, determine the data relevance in software/hardware. Database design and integrity maintenance, normalization.	Design Database Oracle I
B057 - «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Designing SQL Database II	PBSI 2234	BS	Elective subjects	4.0	Bachelor	Computer science	2	Algorithms and data structures I, Algorithms and data structures II, Designing SQL Database I	CI application development II, Development of software applications by Python tools II, Geoinformation technologies in agriculture, Intelligent systems in agriculture, IT Management Methodology, IT project management and entrepreneurship, Java application development II, Neural networks, Pattern recognition	Connecting to the database from an external application. Development of the user interface. Distributed systems and client-server applications. Development of a client-server application. Data models: documentary, Geographic. Development of the server part of a client-server application. SQL administration.	Analyze tasks, determine solutions and select efficient algorithms for task implementation. Define input and output data. Understand the integrity of the developing software. Pick a language and programming tools to it. Develop applications with a database, web portals, separate modules for them, integrate modules into applications. Describe the model and stages of database design, apply database normalization, use modern database control systems, integrate them into applications, control and design databases, create queries to search for data according to various criteria, delete and add data, determine the data relevance in software/hardware. Database design and integrity maintenance, normalization.	Design Database Oracle II
B057 - «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Design Database Oracle II	PBOQ 2258	BS	Elective subjects	4.0	Bachelor	Computer science	3	Algorithms and data structures I, Algorithms and data structures II, Design Database Oracle I	CI application development II, Development of software applications by Python tools II, Geoinformation technologies in agriculture, Intelligent systems in agriculture, IT Management Methodology, IT project management and entrepreneurship, Java application development II, Neural networks, Pattern recognition	CASE-tools database design. Using SQL *Plus. Data Manipulation Language (DML). Multi-user access to the database. Data dictionary. Use of free database space. Determining the size of the database object. Calculation of allocated memory. Backup and restore. Basics of PL/SQL. Program development in PL/SQL: cursors, packages, triggers. Database optimization	Analyze tasks, determine solutions and select efficient algorithms for task implementation. Define input and output data. Understand the integrity of the developing software. Pick a language and programming tools to it. Develop applications with a database, web portals, separate modules for them, integrate modules into applications. Describe the model and stages of database design, apply database normalization, use modern database control systems, integrate them into applications, control and design databases, create queries to search for data according to various criteria, delete and add data, determine the data relevance in software/hardware. Database design and integrity maintenance, normalization.	Designing SQL Database II
B057 - «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Networking and System Administration	STSA 3300 / AS	AS	Elective subjects	5.0	Bachelor	Computer science	3	Ecology and life safety fundamentals, Information technologies, Modern computer architecture, Programming Technology	Cybersecurity, Firewall, Internship, IoT Technology, Parallel programming, Software testing	Internet and modern network technologies. Types of computer networks. Global and local networks. Peer-to-peer and client-server architectures. Basic components of networks, network environment and network devices. Network quality and reliability, Network security. Network protocols and communications. Network services. Ethernet network technologies. Network layer. Transport layer. IP addressing. Dividing IP networks into subnets. Application layer. Network administration.	Explain the principles and concept of building a local, wireless data transfer, virtual network operation, addressing in TCP/IP protocol stack. Build a local, virtual, client-server network, establish the relationship between the IoT. Select and configure the switch, router and other devices for the network. Administer the network. Use IoT technologies.	Basics of Cisco Networking
B057 - «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Basics of Cisco Networking	OOBC 3301	AS	Elective subjects	5.0	Bachelor	Computer science	3	Ecology and life safety fundamentals, Information technologies, Modern computer architecture, Programming Technology	Cybersecurity, Firewall, Internship, IoT Technology, Parallel programming, Software testing	Introduction to network technologies Local Area Networks (LAN), Wide Area Networks (WAN) and the Internet. Setting up the network OS. Address schemes. Communication rules. Network protocols and standards. Data transmission in the network. Physical layer protocols. Network medium for data transmission. Link layer protocols. Environment access control. Ethernet protocol. Local area network (LAN) switches. Address Resolution Protocol (ARP). Network layer protocols. Routers. Setting up a Cisco router. IP addressing. Addressing schemes. Transport layer protocols. TCP and UDP. Application layer protocols. Application layer services.	Explain the principles and concept of building a local, wireless data transfer, virtual network operation, addressing in TCP/IP protocol stack. Build a local, virtual, client-server network, establish the relationship between the IoT. Select and configure the switch, router and other devices for the network. Administer the network. Use IoT technologies.	Networking and System Administration

B057 - «Information technology»	6B06.03 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Programming in Python	PYdP 3241 BS	Elective subjects	6.0	Bachelor	3	1	Algorithms and data structures I, Algorithms and data structures II, Mathematical foundation of information technologies, Programming Technology, The application of discrete mathematics and numerical methods	Development of software tools I, Development of software applications by Python tools II, Internship, Introduction to BIG DATA Technology	Features of the Python language. Data types, operations, operators Input/Output features. Built-in object types: numbers, strings, tuples, lists, dictionaries, sets, file Input/Output. Reading lines with file iterators. Working with binary files. The numpy library for implementing mathematical objects and calculations. Functions and recursion. Range function. Sorting. Lambda functions.	Development, describe and explain the algorithm for solving the problem, determine the problem structure: linear, branched and cyclical; interpret the data structure: lists, arrays, sets, files, strings etc. Explain, select and use "top-down" and "bottom-up" programming techniques, have practical programming skills in one of the programming languages, apply programming knowledge for developing applications. Analyze tasks, determine solutions and select efficient algorithms for task implementation. Define input and output data. Understand the integrity of the developing software. Pick a language and programming tools to it. Develop applications with a database, web portals, separate modules for them, integrate modules into applications.	Object-oriented Programming in Java
B057 - «Information technology»	6B06.03 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Programming in Java	PYdJ 3233 BS	Elective subjects	6.0	Bachelor	3	1	Algorithms and data structures I, Algorithms and data structures II, Mathematical foundation of information technologies, Programming Technology, The application of discrete mathematics and numerical methods	Introduction to the Java platform. Development Environment. Java data types. Expressions and operators. Control structures. Classes and objects. Multiple inheritance. Constructors, methods and class fields. Modifiers Input and output data in Java. Graphic user interface. Containers and components. Libraries. Event handling. Graphics in Java. Work with files.	Development, describe and explain the algorithm for solving the problem, determine the problem structure: linear, branched and cyclical; interpret the data structure: lists, arrays, sets, files, strings etc. Explain, select and use "top-down" and "bottom-up" programming techniques, have practical programming skills in one of the programming languages, apply programming knowledge for developing applications. Analyze tasks, determine solutions and select efficient algorithms for task implementation. Define input and output data. Understand the integrity of the developing software. Pick a language and programming tools to it. Develop applications with a database, web portals, separate modules for them, integrate modules into applications.	Object-oriented Programming in Python	
B057 - «Information technology»	6B06.03 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Object-oriented programming in C#	OOPS 3254 BS	Elective subjects	6.0	Bachelor	3	1	Algorithms and data structures I, Algorithms and data structures II, Mathematical foundation of information technologies, Programming Technology, The application of discrete mathematics and numerical methods	Basic principles of object-oriented programming. Program structure in C#. Data types of the C# programming language. Console class Input/Output. Exceptional situations. Arrays in C#. Symbols and strings in C#. Description of classes in C#. Class methods. Inheritance. Interfaces and structural types. Working with files. Data structures, collections and prototype classes. Microsoft.NET platform.	Development, describe and explain the algorithm for solving the problem, determine the problem structure: linear, branched and cyclical; interpret the data structure: lists, arrays, sets, files, strings etc. Explain, select and use "top-down" and "bottom-up" programming techniques, have practical programming skills in one of the programming languages, apply programming knowledge for developing applications. Analyze tasks, determine solutions and select efficient algorithms for task implementation. Define input and output data. Understand the integrity of the developing software. Pick a language and programming tools to it. Develop applications with a database, web portals, separate modules for them, integrate modules into applications.	Programming in Java, Programming in Python	
B057 - «Information technology»	6B06.03 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Programming microcontrollers and microprocessors	PMM 3248 BS	Elective subjects	7.0	Bachelor	3	2	Electronics and digital circuitry, Modern computer architecture, Operating systems and system programming, Physics	Designing digital devices, FPGA design methods, Fundamentals of robotics, Intelligent sensors, Internship	Choose a programming language for the computer hardware. Program individual blocks of commands in microcontrollers and microprocessors, establish interconnection with external devices in the equipment of the AAC. Protect information in computer systems from external intrusions. Use encryption algorithms in programming, develop programs for encoding, decoding data and anti-virus programs. Describe the application of the software system and OS drivers, explain code of device drivers, use the basics of a programming language competently, use a set of tools for developing drivers. Use principles of parallel programming. Select and use the appropriate language for programming microprocessors and microcontrollers. Compare devices microprocessors and microcontrollers.	Driver programming for OS	
B057 - «Information technology»	6B06.03 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Driver programming for OS	PDDO 3218 BS	Elective subjects	7.0	Bachelor	3	2	Electronics and digital circuitry, Modern computer architecture, Operating systems and system programming, Physics	Designing digital devices, FPGA design methods, Fundamentals of robotics, Intelligent sensors, Internship	Describe the application software system and OS drivers, explain code of device drivers, use the basics of a programming language, competently use set of tools for developing drivers. Use principles of parallel programming. Select and use the appropriate language for programming microprocessors and microcontrollers. Compare devices microprocessors and microcontrollers.	Programming microcontrollers and microprocessors	
B057 - «Information technology»	6B06.03 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Java application development I	RPJ 3209 BS	Elective subjects	7.0	Bachelor	3	2	Algorithms and data structures I, Algorithms and data structures II, Programming in Java, Programming Technology	Geoinformation technologies in agriculture, internship, Java application development II	Analyze tasks, determine solutions and select efficient algorithms for task implementation. Define input and output data. Understand the integrity of the developing software. Pick a language and programming tools to it. Develop applications with a database, web portals, separate modules for them, integrate modules into applications. Design IT-projects, demonstrate software projects (software), use design methods, IT-project management methodology, write terms of reference for methods, know front-end and back-end design, apply the basics of big data analysis technology, analyze and work with big data. Develop client-server applications, identify errors during verification, software testing. Analyze big data.	C# application development I, Development of software applications by Python tools I	

B057- «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Development of software applications by Python tools I	RPPSP 3236	BS	Elective subjects	7.0	Bachelor	Computer science	3	2	Algorithms and data structures I, Algorithms and data structures II, Programming in Python, Programming Technology	Development of software applications by Python tools II, Internship, Introduction to BIG DATA Technology, IoT Technology, Pattern recognition	Creation of sets, Creating dictionaries and examples of use, Functional programming, Recursion, Parameters, Creation of applications with GUI, Graphic libraries Tkinter, PyQt, Object-oriented programming Constraints and destructors, Classes in Python, Definition of data, methods, operations, Inheritance and polymorphism, Composition in the development of classes	Analyze tasks, determine solutions and select efficient algorithms for task implementation. Define input and output data. Understand the integrity of the developing software. Pick a language and programming tools to fit. Develop applications with a database, web portals, separate modules for them, integrate modules into applications. Design IT-projects, demonstrate software projects (software), use design methods, IT-project management methodology, write terms of reference for software, know front-end and back-end design schemes; apply the basics of big data technology, methods of analysis and work with big data. Develop client-server applications, identify errors during verification, software testing. Analyze big data.	C# application development I, Java application development I
B057- «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	C# application development I	RPPS 3257	BS	Elective subjects	7.0	Bachelor	Computer science	3	2	Algorithms and data structures I, Algorithms and data structures II, Object-oriented programming in C#, Programming Technology	C# application development II, Intelligent sensors, Intelligent systems in agriculture, Internship	Net framework және C# тілін. Windows Forms, WinForms, ASP.NET, MVC, Entity Framework, Windows Forms мәтіндік интерфейсін құрастыру, Yandex, PostgreSQL, Oracle, Microsoft Access, PostgreSQL, Oracle, Microsoft Access, PostgreSQL, Oracle, ASP.NET Web-қосымша бағдарламасы, NET Framework, Entity Framework.	Analyze tasks, determine solutions and select efficient algorithms for task implementation. Define input and output data. Understand the integrity of the developing software. Pick a language and programming tools to fit. Develop applications with a database, web portals, separate modules for them, integrate modules into applications. Design IT-projects, demonstrate software projects (software), use design methods, IT-project management methodology, write terms of reference for software, know front-end and back-end design schemes; apply the basics of big data technology, methods of analysis and work with big data. Develop client-server applications, identify errors during verification, software testing. Analyze big data.	Development of software applications by Python tools I, Java application development I
B057- «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Mobile Application Development	RMP 3325	AS	Elective subjects	5.0	Bachelor	Computer science	3	2	Operating systems and system programming, Programming in Java, Programming Technology	Internship, IoT Technology	Creation of a graphical user interface in software for mobile devices. Main control components, location. Principles of creating multi-window applications for mobile devices. Create a background service. Mobile databases. Input/output of information to files. Connecting and configuring the database. Connecting and using libraries. Frameworks for mobile applications. Creation of objects from data in XML and JSON format. Parsing XML and JSON. Tools for organizing client-server interaction. Exception Handling. Maps and geolocation. Audio. Video.	Development, describe and explain the algorithm for solving the problem, determine the problem structure: linear, branched and cyclical; interpret the data structure: lists, arrays, sets, files, strings, etc. Explain, select and use "top-down" and "bottom-up" programming techniques, have practical programming skills in one of the programming languages, apply programming knowledge for developing applications. Analyze tasks, determine solutions and select efficient algorithms for task implementation. Define input and output data. Understand the integrity of the developing software. Pick a language and programming tools to fit. Develop applications with a database, web portals, separate modules for them, integrate modules into applications.	Frontend and Backend development
B057- «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Frontend and Backend development	FBR 3311	AS	Elective subjects	5.0	Bachelor	Computer science	3	2	Algorithms and data structures I, Algorithms and data structures II, Object-oriented programming in C#, Programming Technology	Internship, Introduction to BIG DATA Technology	Introduction to web development. Layout of web pages. Creating pages using HTML, CSS. Developer tools in the browser. Mobile version layout. Creation of JavaScript scripts. Complex events with event handling. XML and JSON formats. Animation in JavaScript. GIT control system. PHP tools. Local web server. Building a virtual machine. Setting up web servers. Frameworks.	Development, describe and explain the algorithm for solving the problem, determine the problem structure: linear, branched and cyclical; interpret the data structure: lists, arrays, sets, files, strings, etc. Explain, select and use "top-down" and "bottom-up" programming techniques, have practical programming skills in one of the programming languages, apply programming knowledge for developing applications. Analyze tasks, determine solutions and select efficient algorithms for task implementation. Define input and output data. Understand the integrity of the developing software. Pick a language and programming tools to fit. Develop applications with a database, web portals, separate modules for them, integrate modules into applications.	Mobile Application Development
B057- «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	IT Management Methodology	MUP 3244	BS	Elective subjects	5.0	Bachelor	Computer science	3	3	Designing SQL Database I, Designing SQL Database II, Programming Technology, Technological entrepreneurship	Internship, Introduction to BIG DATA Technology	Theoretical foundations of IT project management. Project activity. Types of IT projects. Resource management in project activities. Technologies for managing information resources. IT Organizational aspects of project management. Classification of projects. Stages of project development. Definition of resources in the project. Software for managing projects and resources in a project.	Describe the model and stages of database design, apply database normalization, use modern database control systems, integrate them into applications, control and design databases, create queries to search for data according to various criteria, delete and add data, determine the data relevance in software/hardware. Database design and integrity maintenance, normalization. Design IT-projects, demonstrate software projects (software), use design methods, IT-project management methodology, write terms of reference for software, know front-end and back-end design schemes; apply the basics of big data technology, methods of analysis and work with big data. Develop client-server applications, identify errors during verification, software testing. Analyze big data.	IT project management and entrepreneurship
B057- «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	IT project management and entrepreneurship	UIPP 3261	BS	Elective subjects	5.0	Bachelor	Computer science	3	3	Designing SQL Database I, Designing SQL Database II, Programming Technology, Technological entrepreneurship	Internship, Introduction to BIG DATA Technology	Formation of a systematic view on the complexes of project management tasks in the information and communication technologies field. Introduction to IT project management. Initiation, project planning, project scheduling, project quality assurance planning, project risk planning and configuration management, project feasibility assessment and project identification, project management during development, implementation and operations. Definition and characteristics of a digital business model. Digital business model templates. Platform as a business model. Digital Ecosystems. Synthesis of existing business models. Generating ideas for new models.	Describe the model and stages of database design, apply database normalization, use modern database control systems, integrate them into applications, control and design databases, create queries to search for data according to various criteria, delete and add data, determine the data relevance in software/hardware. Database design and integrity maintenance, normalization. Design IT-projects, demonstrate software projects (software), use design methods, IT-project management methodology, write terms of reference for software, know front-end and back-end design schemes; apply the basics of big data technology, methods of analysis and work with big data. Develop client-server applications, identify errors during verification, software testing. Analyze big data.	IT Management Methodology

B057 - «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Designing digital devices	PCU 3301	AS	Elective subjects	5.0	Bachelor	Computer science	3	3	Electronics and digital circuitry, Programming microcontrollers and microprocessors	Intelligent sensors, Internship	Representation levels of digital devices. Microcircuits and their functioning. Logical elements, inverters, repeaters and buffers. Complex logical elements. Decoders and encoders. Multiplexers. Code Comparators. Adders. Code converters. Triggers and registers. Counters. Memory chips: read-only memory and random access memory. Chips DAC and ADC.	Identify types and describe the elemental base of sensors and intelligent systems, apply the basics of neural networks and robotic systems. Demonstrate knowledge of intelligent systems in working with automated systems in the industry. Correct errors in programmable devices. Determine the principles of the neural network, robotics. Understand the circuitry of the computer electronic devices, select machine programming languages for electronic devices, describe the design and operation of computer devices logical integrated circuits, roughly calculate the result obtained, demonstrate circuitry devices (encoders, decoders, transistors). Determine the requirements for the design of integrated circuits, argue their work.	FPGA design methods
B057 - «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	FPGA design methods	MPP 3302	AS	Elective subjects	5.0	Bachelor	Computer science	3	3	The simplest programmable integrated circuits. FPGA architecture. FPGA performance. Main FPGA families. FPGA design based on standard languages. Parallelization of calculations. Parallel operations in FPGA. Pipelining in FPGA. Structural style of programming. FPGA programming. The use of FPGAs for the implementation of video data transmission protocols. Implementation of the VGA interface on the FPGA. Processor architecture. Systems on a chip.	Intelligent sensors, Internship	Identify types and describe the elemental base of sensors and intelligent systems, apply the basics of neural networks and robotic systems. Demonstrate knowledge of intelligent systems in working with automated systems in the industry. Correct errors in programmable devices. Determine the principles of the neural network, robotics. Understand the circuitry of the computer electronic devices, select machine programming languages for electronic devices, describe the design and operation of computer devices logical integrated circuits, roughly calculate the result obtained, demonstrate circuitry devices (encoders, decoders, transistors). Determine the requirements for the design of integrated circuits, argue their work.	Designing digital devices	
B057 - «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Parallel programming	PP 3310	AS	Elective subjects	5.0	Bachelor	Networking and System Administration, Operating systems and system programming, Programming Technology	3	3	Basic information about parallel computers. Performance Analysis. First steps towards parallel programming. Scalable algorithmic methods. Stream programming. MPI shared and other local level languages. ZPL language and other global languages. Perspective directions in parallel programming	Internship, IoT Technology, Neural networks	Analyze tasks, determine solutions and select efficient algorithms for task solving. Describe input and output data. Understand the integrity of the developing software. Perform testing tools to it. Develop applications with a database, web portals, separate modules for them, integrate modules into applications. Describe the computer system architecture, the operation of computing parallel systems, classify computer systems according to the type processor, the memory principle; explain the idea of parallelization in multi-core processors. Install/minimum OS. To describe the modernization of the computer system architecture, install and update the internal components of the computer system architecture. Describe the application software system and OS drivers, explain code of device drivers, use the basics of a programming language, competently use a set of tools for developing drivers. Use principles of parallel programming. Select and use the appropriate language for programming microprocessors and microcontrollers. Compare devices microprocessors and microcontrollers.	Software testing	
B057 - «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Software testing	TPO 3304	AS	Elective subjects	5.0	Bachelor	Networking and System Administration, Operating systems and system programming, Programming Technology	3	3	Methods and practices of designing complex software, as well as the study of the main theoretical issues of formalization, certification and quality assurance according to the methods and algorithms of software quality control (software)	Fundamentals of robotics, Internship, Introduction to BIG DATA Technology	Design IT-projects, demonstrate software projects (software), use design methods, IT-project management methodology, write terms of reference for software, know front-end and back-end design schemes, apply the basics of big data technology, methods of analysis and work with big data. Develop client-server applications, identify errors during verification, software testing. Analyze big data.	Parallel programming	
B057 - «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Intelligent systems in agriculture	ISSH 3324	AS	Elective subjects	5.0	Bachelor	C# application development I, Designing SQL Database I, Designing SQL Database II, Programming Technology	3	3	The main directions of artificial intelligence. Approaches to understanding AI: symbolic approach, logical approach; agent-oriented approach; hybrid approach. Intelligent software systems. Functional structure of intelligent systems. Tools for building AI. Biological modeling of AI. Artificial neuron model. Training of neural networks. Machine learning methods. Application of AI methods in AIC technologies.	C# application development II, Internship	Design IT-projects, demonstrate software projects (software), use design methods, IT-project management methodology, write terms of reference for software, know front-end and back-end design schemes; apply the basics of big data technology, methods of analysis and work with big data. Develop client-server applications, identify errors during verification, software testing. Analyze big data. Choose a programming language for the computer hardware. Program individual blocks of commands in microcontrollers and microprocessors, establish interconnection with external devices in the equipment of the AIC. Protect information in computer systems from external intrusions. Use encryption algorithms in programming, develop programs for encoding, decoding data and anti-virus programs	Geoinformation technologies in agriculture	
B057 - «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Geoinformation technologies in agriculture	GTSH 3310	AS	Elective subjects	5.0	Bachelor	Designing SQL Database I, Designing SQL Database II, Java application development I, Programming Technology	3	3	The main sources and types of data in GIS, systems for their presentation and processing. Data models in geoinformation systems. GIS-system. General concepts of remote sensing of the Earth. Fields of application of remote sensing of the earth in agriculture	Internship, Java application development II	Design IT-projects, demonstrate software projects (software), use design methods, IT-project management methodology, write terms of reference for software, know front-end and back-end design schemes; apply the basics of big data technology, methods of analysis and work with big data. Develop client-server applications, identify errors during verification, software testing. Analyze big data. Choose a programming language for the computer hardware. Program individual blocks of commands in microcontrollers and microprocessors, establish interconnection with external devices in the equipment of the AIC. Protect information in computer systems from external intrusions. Use encryption algorithms in programming, develop programs for encoding, decoding data and anti-virus programs. Identify types and describe the elemental base of sensors and intelligent sensors, apply the basics of neural networks and robotic systems. Demonstrate knowledge of intelligent systems in working with automated systems in the industry. Correct errors in programmable devices. Determine the principles of the neural network, robotics.	Intelligent systems in agriculture	

B057 - «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Cybersecurity	Kib-4321	AS	Elective subjects	6.0	Bachelor	Computer science	4	1	Basics of economics and law, Networking and System Administration, Operating systems and system programming, Programming Technology	Internship, IoT Technology	Basic concepts of information security: threats, vulnerabilities, attacks. Features of modern cyber systems and cyber attacks. Methods and means of information protection. Cryptographic methods of information protection. Asymmetric cryptosystems. Key management. Authentication methods: identification, authentication, authorization. Passwords and biometric systems. Electronic digital signature. Intrusion detection. Antivirus means of information protection. Information leakage prevention systems. The main channels of information leakage and methods for their detection. Safe recovery of IS.	Choose a programming language for the computer hardware. Program individual blocks of commands in microcontrollers and microprocessors, establish interconnection with external devices in the equipment of the AIC. Protect information in computer systems from external intrusions. Use encryption algorithms in programming, develop programs for encoding, decoding data and anti-virus programs	Firewall
B057 - «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Firewall	ME-4309	AS	Elective subjects	6.0	Bachelor	Computer science	4	1	Basics of economics and law, Networking and System Administration, Operating systems and system programming, Programming Technology	Internship, IoT Technology	Analysis of information security threats to corporate systems. Architecture of the information security system. Hardware and software solutions for information security. Identification and authentication of network objects. Information security in the Internet space. Access servers (firewalls). Principles of construction and operation of firewalls. Firewall and network segmentation technologies. Types of firewalls. Creation of demilitarized zones. Technologies for secure remote access to LAN resources. Content Technologies for controlling user access to Internet resources. Content filtering technologies. Organization of protection of virtual private networks, IS virtualization.	Choose a programming language for the computer hardware. Program individual blocks of commands in microcontrollers and microprocessors, establish interconnection with external devices in the equipment of the AIC. Protect information in computer systems from external intrusions. Use encryption algorithms in programming, develop programs for encoding, decoding data and anti-virus programs.	Cybersecurity
B057 - «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Java application development II	RPI 4235	BS	Elective subjects	6.0	Bachelor	Computer science	4	1	Designing SQL Database I, Designing SQL Database II, Geoinformation technologies in agriculture, Java application development I, Programming in Java	Internship, Neural networks	Threads: interfaces and methods. Thread interaction. Multithreading. Messaging System. Separation of interfaces. Reflecting. Server components. Database Service: Utilities. Singleton pattern. Exceptions in Java. Working with date and time. Decorator pattern. String streams. Serializable interface. Working with an XML document. Java Database Connectivity. Database class. Java application security. Data protection.	Apply the basics of scientific research methods and written scientific communication. Freely use written communication techniques to perform academic work, freely express ideas on the problem under study. Adhere to the principles and culture of academic integrity. Analyze tasks, determine solutions and select efficient algorithms for task implementation. Define input and output data. Understand the integrity of the developing software. Pick a language and programming tools to it. Develop applications with a database, web portals, separate modules for them, integrate modules into applications. Design IT-projects, demonstrate software projects (software), use design methods, IT-project management methodology, write terms of reference for software, know front-end and back-end design schemes, apply the basics of big data technology, methods of analysis and work with big data. Develop client-server applications, identify errors during verification, software testing. Analyze big data.	C# application development II, Development of software applications by Python tools II
B057 - «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Development of software applications by Python tools II	RPPSP1 4259	BS	Elective subjects	6.0	Bachelor	Computer science	4	1	Designing SQL Database I, Designing SQL Database II, Development of software applications by Python tools I, Programming in Python, Programming Technology	Internship, IoT Technology, Pattern recognition	Principles of object-oriented programming. Events, signals, slots, RE regular expression library. Network programs. Libraries urllib, BeautifulSoup, Using Web Services. XML - extensible markup language. Application programming interfaces (API). Use of databases and SQL language. Machine learning in Python: sk-learn. Data visualization in Python. Automation of tasks on the computer.	Apply the basics of scientific research methods and written scientific communication necessary for communication in a professional academic environment. Freely use written communication techniques to perform academic work, freely express ideas on the problem under study. Adhere to the principles and culture of academic integrity. Analyze tasks, determine solutions and select efficient algorithms for task implementation. Define input and output data. Understand the integrity of the developing software. Pick a language and programming tools to it. Develop applications with a database, web portals, separate modules for them, integrate modules into applications. Design IT-projects, demonstrate software projects (software), use design methods, IT-project management methodology, write terms of reference for software, know front-end and back-end design schemes, apply the basics of big data technology, methods of analysis and work with big data. Develop client-server applications, identify errors during verification, software testing. Analyze big data.	C# application development II, Java application development
B057 - «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	C# application development II	RPS1 4260	BS	Elective subjects	6.0	Bachelor	Computer science	4	1	C# application development I, Designing SQL Database I, Designing SQL Database II, Intelligent systems in agriculture, Object-oriented programming in C#	Intelligent sensors, Internship	ADO.NET technologies. ADO.NET objects. Connecting to a Microsoft SQL Server database. Creation of stored procedures. Calling stored procedures. Working with transactions. DataTable, DataRow, and DataColumn objects. DataView object. Output related tables. Introspection to XML. Reading and writing XML documents. Transferring changes to the database using the Command object. Transferring changes to the database using stored procedures. Command Builder object. Creation and use of a web service	Apply the basics of scientific research methods and written scientific communication necessary for communication in a professional academic environment. Freely use written communication techniques to perform academic work, freely express ideas on the problem under study. Adhere to the principles and culture of academic integrity. Analyze tasks, determine solutions and select efficient algorithms for task implementation. Define input and output data. Understand the integrity of the developing software. Pick a language and programming tools to it. Develop applications with a database, web portals, separate modules for them, integrate modules into applications. Design IT-projects, demonstrate software projects (software), use design methods, IT-project management methodology, write terms of reference for software, know front-end and back-end design schemes, apply the basics of big data technology, methods of analysis and work with big data. Develop client-server applications, identify errors during verification, software testing. Analyze big data.	Development of software applications by Python tools II, Java application development II

B057 - «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Pattern recognition	RO 4246	BS	Elective subjects	6.0	Bachelor	Computer science	4	2	Designing SQL Database I, Database SQL Database II, Development of software applications by Python tools I, Development of software applications by Python tools II	Internship	The subject and objectives of digital image processing. Image classification. Point methods of image processing. Spatial methods of image processing. Learning the recognition system. Recurrent learning algorithms for pattern recognition. Neural network methods for classifying and searching for similar images. Analysis and synthesis of images. Neural network methods of video recognition.	Design IT-projects, demonstrate software projects (software), use design methods, IT-project management methodology, write terms of reference for software, know front-end and back-end design schemes, apply the basics of big data technology, methods of analysis and work with big data. Develop client-server applications, identify errors during verification, software testing. Analyze big data.	Intelligent sensors
B057 - «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Intelligent sensors	IS 4262	BS	Elective subjects	6.0	Bachelor	Computer science	4	2	C# application development I, C# application development II, Designing digital devices, Programming microcontrollers and microprocessors	Internship	Microsystem technologies. Mechanical sensors. Deformation sensors. Mechanical displacement sensors. Operation principles of the global positioning system (GPS) and GPS sensors. Linear displacement sensors. Angular displacement sensors. Accelerometers and gyroscopes. Vibration and chromatographic sensors. Acoustic sensors: microphones, hydrophones, stethoscopes. Intelligent acoustic sensors: voice recorders, sound analyzers, wireless headset, hydroacoustic telephone, listening devices. Active acoustic sensors: transmitters, echo sounders, sonars. Electrical sensors: resistive, capacitive, inductive. Volume sensors: on diodes and bipolar transistors. Digital camera and video cameras, thermal imagers, fingerprint sensors. Magnetic sensors. Inductive sensors. Radar sensors and radars.	Identify types and describe the elemental base of sensors and intelligent sensors, apply the basics of neural networks and robotic systems. Demonstrate knowledge of intelligent systems in working with automated systems in the industry. Correct errors in programmable devices. Determine the principles of the neural network, robotics. Understand the circuitry of the computer electronic devices, select machine programming languages for electronic devices, describe the design and operation of computer devices logical integrated circuits, roughly calculate the result obtained, demonstrate circuitry devices (encoders, decoders, transistors). Determine the requirements for the design of integrated circuits, argue their work.	Pattern recognition
B057 - «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Fundamentals of robotics	OR 4305	AS	Elective subjects	7.0	Bachelor	Computer science	4	2	Programming microcontrollers and microprocessors, Programming Technology, Software testing	Internship	Formation of students knowledge and skills in designing and programming robots: To program the robot's movement, to connect and program the robot's response to sensors, the purpose of structural and electronic parts of robotic designers, features of standard models of robots, the purpose of sensors.	To study the basic concepts of the laws of engineering mechanics, mechanics of materials, robotics and safety measures. To organize the production process, operation of MTP and maintenance of modern agricultural machinery with the introduction of innovative technologies and with the creation of business entities	Neural networks
B057 - «Information technology»	6B06103 - «Computer Engineering»	Full-time (bachelor 4 years) trimester	Neural networks	NS 4303	AS	Elective subjects	7.0	Bachelor	Computer science	4	2	Designing SQL Database I, Designing SQL Database II, Introduction to BIG DATA Technology, Parallel programming	Internship	Basic concepts of the neural networks theory. Structure and properties of an artificial neuron. Neural network architectures: a network of one neuron, multilayer neural networks, layered architectures. Neural network training methods: supervised learning, error backpropagation algorithm, unsupervised learning. Perceptron. Multilayer perceptron. Neural networks of Kohonen. Neural networks of counterpropagation.	Identify types and describe the elemental base of sensors and intelligent sensors, apply the basics of neural networks and robotic systems. Demonstrate knowledge of intelligent systems in working with automated systems in the industry. Correct errors in programmable devices. Determine the principles of the neural network, robotics.	Fundamentals of robotics

The catalog of elective disciplines was reviewed and approved by the faculty council, protocol № 19.15.06.2024.

Head of the Department of Computer Science

A. Amgulova

