AGREED
Executive director of
«Internet Society Kazakhstan» PO
_____ Nurlybayev T.A.
_____ 2023

APPROVED
Rector
of JSC «International Information
Technology University»
_____ Hikmetov A.U.
«30» 03 2023

# EDUCATIONAL PROGRAM

## 6B06106 «Computer Systems and Software Engineering»

Code and classification of the field of education: 6B06 – Information and Communication Technology

Code and classification of training area: 6B061 – Information and Communication Technology

Group of educational programs: B057 – Information Technology

ISCED level: 6

NQR level: 6

ORC level: 6

Duration: 4 years

Number of credits: 240

AGREED
Director of
«KnewIT Programming School» LLC
_____ Bekaulov N.M.
«____» _____ 2023

AGREED
Executive director of
«KazRENA Association» ALE
_____ Tatybayev S.K.
«____» _____ 2023

Almaty, 2023

# Content

# List of abbreviations and notation

| | |
|---|---|
| BC | Basic competence |
| BM | Base module |
| HE | Higher education |
| SCES | State compulsory education standard |
| EQF | European qualification framework |
| EEF | European Education Foundation |
| KSC | Knowledge, skills, cum-savvy |
| NCO | National Classification of Occupations |
| NQF | National Qualifications Framework |
| NQS | National qualifications system |
| HM | Humanitarian module |
| CM | Common module |
| EP | Educational program |
| GPM | General Professional Module |
| IQF | Industry Qualifications Framework |
| PS | Professional standard |
| PE | Postgraduate education |
| PC | Professional competence |
| PM | Professional module |
| SW | Software |
| WG | Working group |
| RK | The Republic of Kazakhstan |
| LO | Learning outcome |
| SM | Special module |
| QMS | Quality Management System |
| SEM | Socio-economic module |
| TVE | Technical and vocational education |
| TaVPE | Technical and vocational education and post-secondary education |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| UNESCO | Specialized agency of the United Nations Educational, Scientific and Cultural Organization |
| Cedefop | European Center for Development of Vocational Training |
| DACUM | from Eng. Developing curriculum |
| ECVET | European Credit System for vocational education and training |
| EQAVET | European Quality Assurance in Vocational Education and Training |
| ENQA | European Association for Quality Assurance in Higher Education / Europe-Skye association by to ensure qualities at higher education |
| ESG | Standards and Guidelines for Quality Assurance in the European Higher Education Area |
| FIBAA | International Agency (non-profit foundation) for accreditation and examination of the quality of higher education (Bonn, Germany) |
| IQM-HE | Internal Quality Management in Higher Education |
| TACIS | Technical Assistance for the Commonwealth of Independent States |
| WSI | WorldSkills International |

## 1 Description of the educational program

The educational program 6B06106 «Computer Systems and Software Engineering» is designed to implement the principles of a democratic nature of educational management, expanding the boundaries of academic freedom and the authority of educational institutions, which will ensure the adaptation of the technical and vocational education system to the changing needs of society, the labor market economy. The flexibility of the program will allow you to take into account the abilities and needs of the individual, production and society.

The educational program ensures the application of an individual approach to students, ensures the transformation of professional competencies from professional standards and qualification standards into learning outcomes. Provides student-centered learning - the principle of education, involving a shift in emphasis in the educational process from teaching to learning.

The educational program «Computer Systems and Software Engineering» prepares specialists of a wide profile in the field of software development for any areas of human activity. Preparation for this educational program includes disciplines that form competencies in the field of data analysis and machine learning, network technologies, robotic systems and graphic computing.

The area of professional activity of graduates is state and private enterprises and organizations that develop, implement and use computer hardware and software in various fields, namely: telecommunications, science and education, healthcare, agriculture, mechanical engineering, metallurgy, transport, services, administrative management, economics, business, various technology management, etc.

## 2 The goal and objectives of the educational program

**The goal of the EP** – is to provide practice-oriented training of highly qualified specialists in software development in various fields with competencies in the field of data analysis, network technologies, robotics and graphic computing.

**The objectives of the EP:**

1. To prepare a universal specialist who has knowledge in mathematics, ICT, computer sciences; able to use modern information and communication technologies in substantive activities.

2. To teach students how to formalize the subject area of a software project and develop specifications for software product components.

3. To develop the ability to design software architecture and provide a high level of continuity and quality of complex software development.

4. To teach students to design and develop user interfaces, commercial software components, databases and embedded software modules.

5. To acquaint students with the methods and tools for researching software code to identify / eliminate errors and malfunctions in the software.

6. To provide knowledge to students on the design of logical database schemes using relational, object-oriented, object-relational, key-value schemes for simple and complex defined systems.

7. To acquaint students with data analysis methods and machine learning algorithms for their application in various fields of human detail.

8. To develop students' skills in developing multi-robotic systems using artificial intelligence, sensory technologies, IoT, etc.

9. To train students in network technologies to configure networks of various sizes, prevent threats and troubleshoot.

10. To acquaint students with advanced technologies of three-dimensional visualization.

## 3 Requirements for the results of the mastering of the educational program

The following examination forms are used as an assessment of learning outcomes: computer testing, a written exam (answers on the sheets), an oral exam, a project (passing a course project), practical (open questions on a computer, solving problems on a computer, including in ACM format) comprehensive (test / written / oral + others). In accordance with table 1, the following exams are recommended:

Table 1

| № | Exams form | Recommended share, % |
|---|---|---|
| 1 | Test | 10% |
| 2 | Written | 10% |
| 3 | Oral | 5% |
| 4 | Project | 30% |
| 5 | Practical | 30% |
| 6 | Complex | 15% |

Final attestation is help on the form of defending a diploma project.

## 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 Technology |
| 2 | Code and classification of training areas | 6B061 – Information and Communication Technology |
| 3 | Group of educational programs | B057 – Information Technology |
| 4 | Name of the educational program | 6B06106 Computer Systems and Software Engineering |
| 5 | Short description of the program | The educational program «Computer Systems and Software Engineering» prepares specialists of a wide profile in the field of software development for any areas of human activity. Preparation for this educational program includes disciplines that form competencies in the field of data analysis and machine learning, network technologies, robotic systems and graphic computing. |
| 6 | Purpose of EP | To provide practice-oriented training of highly qualified specialists in software development in various fields with competencies in the field of data analysis, network technologies, robotics and graphic computing |
| 7 | ISCED level | 6 |
| 8 | NQF level | 6 |
| 9 | IQF level | 6 |
| 10 | List of competencies : GC1: To know: socio-ethical values based on public opinion, traditions, customs, social norms and focus on them in their professional activities; history, traditions and culture of the peoples of Kazakhstan; human and civil rights and freedoms; fundamentals of the legal system and legislation of Kazakhstan; trends in the social development of society; the basics of physical culture and the principles of a healthy lifestyle. GC2: To be capable of written and oral communication, including professional in the state language, the language of interethnic communication and English; ability is logically true, | |

reasoned and clearly build oral and written speech.

BC1: To be competent in the choice of mathematical modeling methods for solving specific engineering problems, including the willingness to identify the natural science essence of the problems arising in the process of professional activity, and the ability to attract the appropriate physical and mathematical apparatus for its solution.

BC2: The ability to use modern information and communication technologies in substantive activities, to analyze information sources.

BC3: The ability to analyze the architecture of computer systems, the main components of a computer.

PC1: The ability to formalize the subject area of a software project and develop specifications for software product components.

PC2: The ability to design and develop user interfaces, commercial software components, databases and embedded software modules.

PC3: To be competent in choosing software, DBMS, programming language.

PC4: The ability to manage the software development process, the development team, as well as evaluate the economic efficiency of the project.

PC5: The ability to design, configure, operate computer systems and networks.

PC6: The ability to analyze various types of data, apply knowledge extraction methods.

PC7: The ability to design, develop and operate robotic systems.

PC8: The ability to develop three-dimensional visualizations using modern technologies.

| 11 | Learning outcomes. Students will be able to: |
|---|---|

LO1: Demonstrate the ability to use basic math tools to solve professional problems.

LO2: Analyze the structure of the main components of the computer, use a wide range of technologies of internal and external memory; write program code for manipulating bits in the processor.

LO3: Apply suitable data structures and develop appropriate algorithms for solving various computational problems.

LO4: Apply various tools for software development, user interface, storage and data processing systems.

LO5: Use various software development methodologies, draw up software documentation using the required diagrams, develop models of the logical and physical architecture of the software system, database, and manage the development process.

LO6: Develop effective data storage systems and methods for their processing and analysis using machine learning algorithms.

LO7: Own technologies for administering systems and networks of any configuration, troubleshooting and threat prevention.

LO8: Design, operate and maintain robotic systems.

LO9: Demonstrate the skills to develop complex three-dimensional visualizations using computer vision technologies, augmented and virtual realities.

LO10: Independently critically analyze modern sources, draw conclusions, argue them and make decisions based on information.

| 12 | Form of study | Full-time |
|---|---|---|
| 13 | Language of instruction | English |
| 14 | Number of credits | 240 ECTS credits |
| 15 | Awarded academic degree | Bachelor in Information and Communication Technology in educational program 6B06106 «Computer Systems and Software Engineering» |
| 16 | Developers and authors: | «International Information Technology University» JSC, Computer Engineering and Information Security Department: <br> - Chinibayeva T.T., PhD, head of the «CEIS» |

| | | |
|---|---|---|
| | | department, Assistant prof., |
| | - | Tokanov O.S., MSc, senior lecturer |

**4.2 Matrix of correlation of learning outcomes of the educational program with competencies**

| | LO1 | LO2 | LO3 | LO4 | LO5 | LO6 | LO7 | LO8 | LO9 | LO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **BC1** | V | | | | | | | | | |
| **BC2** | | | | | | | | | | V |
| **BC3** | | V | | | | | | | | |
| **PC1** | | | | | V | | | | | |
| **PC2** | | | V | V | | V | | | | |
| **PC3** | | | V | V | | | | | | |
| **PC4** | | | | V | | | | | | |
| **PC5** | | | | | | | V | | | |
| **PC6** | | | | | | V | | | | |
| **PC7** | | | | | | | | V | | |
| **PC8** | | | | | | | | | V | |

## 4.4 List of modules and learning outcomes

| Module name | Total number of credits | Learning outcomes | Criteria for assessing learning outcomes | Module-forming disciplines |
|---|---|---|---|---|
| **GENERAL EDUCATION MODULES** | | | | |
| **General education module** | 10 | The student has an idea of the principles and laws of the historical development of society, the historical periodization of the history of Kazakhstan, the place of the history of Kazakhstan in world history and the history of Eurasia, the place and role of philosophy in the life of society and man; the main stages of development of world and Kazakh philosophical thought. | Testing, interview, oral report, term paper, presentation, midterm. | history of Kazakhstan; Philosophy |
| **Social and political knowledge module** | 16 | The student has an idea of socio-ethical values based on public opinion, traditions, customs, social norms and focuses on them in their professional activities; traditions and culture of the peoples of Kazakhstan; the rights and freedoms of man and citizen; the foundations of the legal system and legislation of Kazakhstan; social development trends in society; the basics of physical culture and the principles of a healthy lifestyle. | Testing, interview, oral report, term paper, presentation, midterm. | Political science; Sociology; Psychology; Cultural studies; Physical training |
| **Language module** | 25 | The student can freely express himself in writing and verbally, including professionally in the state language, the language of interethnic communication and English; knows how to logically correctly, reasonably and clearly build oral and written speech. | Testing, interview, oral term paper, presentation, midterm. | Foreign language; Kazakh (Russian) language; Professional Kazakh (Russian) language; Professionally-oriented foreign language |
| **BASIC MODULES** | | | | |
| **Basic module** | 9 | The student is able to use modern ICT in professional activities, independently versatile and critically analyze modern sources, draw conclusions, argue them and make decisions based on information. | Testing, oral interview, report, term paper, presentation, laboratory work, midterm control. | Information and communication technology; Research fundamentals |
| **Math module** | 18 | The student is able to use basic mathematical tools to solve professional problems. | Testing, oral interview, course, laboratory, control work, midterm. | Algebra and geometry; Mathematical analysis; Theory of probability and mathematical statistics; Discrete math |
| **Hardware module** | 24 | The student is able to analyze the structure of the main components of the computer, use a wide range of technologies of internal and external memory; write program code for manipulating bits in the processor. | Testing, oral interview, course, laboratory, control work, midterm. | Physics; Basic circuit theory; Design and simulation of electronic devices; Fundamentals of logic design; Architecture and organization of computer systems |

## PROFESSIONAL MODULES

| | | | |
|---|---|---|---|
| **Programming module** | 40 | The student is able to apply suitable data structures and develop appropriate algorithms to solve various computational problems. The student is able to use various tools for software development, user interface, storage and data processing systems. | Testing, oral interview, course, laboratory, control work, midterm. | Introduction to programming |
| | | | | Algorithmization and programming |
| | | | | Object oriented programming |
| | | | | Algorithms and data structures |
| | | | | Programming in PL/SQL |
| | | | | Database design. Introduction to SQL |
| | | | | Programming in Python |
| | | | | Web technologies |
| **Advanced programming module** | 40 | The student is able to use various tools for software development, user interface, storage and data processing systems. | Testing, oral interview, course, laboratory, control work, midterm. | UX/UI development |
| | | | | Web-component Development (Java EE) |
| | | | | Application development foundation .NET |
| | | | | Business component and Web-services development (Java EE) |
| | | | | Mobile technologies and applications |
| | | | | Full stack development |
| | | | | ASP.NET application development |
| **Network and system administration module** | 46 | The student is able to administer systems and networks of any configuration, troubleshoot and prevent threats. | Testing, oral interview, course, laboratory, control work, midterm. | Introduction to computer networks |
| | | | | Operating systems |
| | | | | Fundamentals of information security |
| | | | | Switching, routing, and wireless essentials |
| | | | | Enterprise networking, security, and automation |
| | | | | Network programming |
| | | | | Cloud computing and virtualization |
| | | | | Administration of systems |
| | | | | System level programming |
| **Project module** | 13 | The student is able to use various software development methodologies, draw up program documentation using the required diagrams, develop models of the logical and physical architecture of the software system, database, and manage the development process. | Testing, oral interview, course, laboratory, control work, midterm. | Economics and organization of production |
| | | | | Project management |
| | | | | Software architecture and design |

## 4.3 Information about courses

| Code | Name of the course | Short description of the course | Number of credits | Formed competencies (codes) |
|---|---|---|---|---|
| **1 General disciplines (GD)** | | | | |
| **1.1 Mandatory component (MC)** | | | | |
| HK 6002 | Modern history of Kazakhstan | The laws of the historical process, the place of man in the historical process are studied. Historical knowledge is given about the main stages of development of modern Kazakhstan; focuses on the problems of historical and cultural processes and the development of Kazakhstan. | 5 | GC1 |
| SPS 6001 | Philosophy | Studying the principles of understanding philosophy as a methodology of human activity, the main directions and problems of the world. The formation of a holistic vision of philosophy as a special form of knowledge of the world, its main problems and methods of studying them in the context of future professional activity. | 5 | GC1 |
| LAN 6001A | Foreign language | Written and oral communication skills in English are taught. | 5 | GC2 |
| LAN 6002A | Foreign language | Written and oral communication skills in English are taught. | 5 | GC2 |
| LAN6001KR | Kazakh (Russian) language | The skills of written and oral communication in the state language (the language of interethnic communication) are inculcated. | 5 | GC2 |
| LAN6002KR | Kazakh (Russian) language | The skills of written and oral communication in the state language (the language of interethnic communication) are inculcated. | 5 | GC2 |
| ICT6001 | Information and communication technology | The skills of applying information and communication technologies in substantive activities are taught. | 5 | |
| SPS6003 | Political science | The fundamentals of global political processes and the laws of political life are being studied. | 2 | GC1 |
| SPS 6002 | Sociology | The development of sociological imagination, understanding of sociology as a science. The study of sociological subject areas, directions and research methods. The basic concepts of sociological theories are discussed, as well as how society and social processes determine our life. | 2 | GC1 |
| SPS6005 | Psychology | The course is aimed at teaching students of non-psychological specialties. The basics of psychological science are considered, including topics such as an introduction to psychology, activity psychology, cognitive processes, personality psychology. | 2 | GC1 |
| SPS6004 | Cultural studies | The course is aimed at implementing fundamental ideas for the preservation of the cultural heritage of Kazakhstanis and the national code in the context of globalization, the modernization of public consciousness and human spirituality in the process of developing national art and cultural institutions. | 2 | GC1 |
| PhC6005 | Physical training | The ability to understand the practical use of healthy living standards, including prevention issues, is being instilled. | 2 | GC1 |
| PhC6006 | Physical training | | 2 | GC1 |
| **1.2 University component (UC)** | | | | |
| ECO6002 | Economics and organization of | New trends in the economy and organization of production are discussed with examples from real life | 5 | PC4 |

| | production | and practice. The structure of the national economy, the enterprise and the organization of its production, capital and property of enterprises, material resources, wages and costs of production, income, profit, profitability, competitiveness, economic efficiency of production are considered. | | |
|---|---|---|---|---|
| **2 Basic disciplines (BD)** | | | | |
| **2.1 University component (UC)** | | | | |
| PHY6001 | Physics | Studying the basic laws of classical mechanics, electricity, magnetism, thermodynamics, quantum mechanics, special relativity in search of ways to solve physical problems. | 7 | BC1, BC3 |
| MAT6001** | Algebra and geometry | Studying the elements of linear algebra and analytic geometry using real life and various science examples. | 4 | BC1 |
| SFT6301 | Algorithmization and programming | More complex, advanced algorithms and data structures using the C ++ programming language are considered. | 6 | PC2, PC3 |
| MAT6002 | Mathematical analysis | We consider such concepts as limits and differentiation of functions of one variable, indefinite and definite (Riemannian) integrals of functions with applications, as well as an introduction to topics related to ordinary differential equations. | 6 | BC1 |
| MAT6006 | Theory of probability and mathematical statistics | The course focuses on the probability and statistics of any events, as well as on the relationship between mathematics and programming through an interdisciplinary training program that deepens the mathematical understanding of probability and develops the skills of logical and algorithmic thinking. | 4 | BC1 |
| MAT6005 | Discrete math | The study of discrete objects, the solution of combinatorial problems, the study of types of mappings and binary relations, the reduction of propositional algebra formulas to normal forms, the application of logic algebra to the theory of switching circuits. The capabilities for analysis and synthesis, and mathematical maturity are developing. | 4 | BC1 |
| HRD6302 | Architecture and organization of computer systems | We study computer architecture with an emphasis on a quantitative approach to the trade-off between cost and performance. Command sets, pipelining, caching, physical memory, virtual memory, superscalar and disordered execution of I / O commands, multithreading, and introduction to multiprocessors with shared memory are considered. | 5 | BC3 |
| OOP 2209 | Information theory | Information theory is a branch of applied mathematics and computer science involving the quantification of information. The aim of course is to form a system of knowledge on the basics of information theory and its application to the practice of modern information systems. Objectives of the course: concept and types of information systems, the concept of entropy and ways of its assess, the concept of information, ways of quantify the information, theoretical and practical aspects of efficient coding, theoretical and practical aspects of noiseless coding, data transfer systems, modulation and demodulation. | 4 | BC1 |
| SFT6302 | Algorithms and data structures | The principles of algorithm development, analysis of algorithms and fundamental data structures are considered. The emphasis is on choosing appropriate data structures and developing effective and correct algorithms for their implementation. Important elements of the course are measuring the performance | 2 | PC2, PC3 |

| | | and effectiveness of programs when comparing and comparing the results of small programs written in different languages. | | |
|---|---|---|---|---|
| LAN6007K | Business correspondence in the state language | Business language skills are taught. The formation and development of listening, speaking, reading and writing skills on topics related to professional activities, as well as the development of social skills such as presentations. | 2 | GC2 |
| PP6301 | Educational practice | The acquisition of primary professional skills and the consolidation of skills by independently solving the problems of algorithmization, design and practical implementation of programs using modern programming technologies. | 2 | BC2, PC2, PC3 |
| RM6301 | Research fundamentals | Studying the issues of practical organization of scientific research, analysis and generalization of research results, mastery of the theory of engineering decision making, the basics of project management, requirements analysis, architecture development, detailed design, development of user interfaces and testing methods. | 4 | BC2 |
| **2.2 Elective courses (EC)** | | | | |
| SFT6308 | System level programming | This course is based on a class of basic concepts that are necessary for systems based on hardware, firmware, operating systems, applications, platforms and libraries. Key and fundamental aspects of computers are used to develop complex interactions between several independent computing elements that underpin modern machines, with a special emphasis on parallelism. | 6 | BC3 |
| SFT6305 | Database design. Introduction to SQL | During the course, students will learn how to create relational databases, going through all the stages of the database design process (conceptual, logical and physical). In the second part of the course, students will learn the basics of Structured Query Language (SQL). | 4 | PC2, PC3, PC6 |
| NET6301 | Introduction to computer networks | Acquaintance with the basic network concepts and technologies, as well as developing the skills of planning and implementing small networks. The architecture, structure, functions, components and models of the Internet and other computer networks are considered. The principles and structure of IP addressing, as well as the basics of Ethernet concepts, media and operations, are presented as the basis for the curriculum. | 4 | PC5 |
| SFT6304 | Programming in Python | Familiarity with the Python programming language and its libraries. The emphasis is on procedural programming, non-strict types of variables, designing algorithms, working forms of applications (libraries), object-oriented programming, creating web and database applications, as well as data preprocessing. | 4 | PC2, PC3 |
| EGR6301 | Operating systems | Acquaintance with modern operating systems, their functionality and structure. Methods of process planning, interprocess communication, process synchronization, deadlock processing, main memory management during process execution, classical internal algorithms and storage management structures, and design of an input-output system are considered. | 5 | BC3, PC5 |
| SFT6306 | Software architecture and design | The study of large systems and how they are decomposed into subsystems and components. Various notations and formalisms, detailed design and architecture are considered. The use of various notation with an emphasis on UML is explored. The role of | 4 | PC1 |

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|---|---|---|---|---|
| | | architecture and detailed project specifications are considered in terms of risk management. | | |
| SEC6301 | Fundamentals of information security | It covers basic security concepts, principles and technologies, cryptography, attack methods and security monitoring. Studying basic security methods for searching for threats on the network using various popular security tools in a real network infrastructure. | 4 | BC2, PC5 |
| **3 Professional disciplines (PD)** | | | | |
| **3.1 University component (UC)** | | | | |
| PM6301 | Project management | Learning the basics of project management and the necessary steps to ensure successful project management. Studying the main characteristics of project management and various roles in the project to ensure success. Application of key skills to the project to evaluate, plan and develop control mechanisms. | 4 | PC1, PC4 |
| LAN6003PA | Professionally-oriented foreign language | Business English skills are taught. The formation and development of listening, speaking, reading and writing skills in English on topics related to professional activities, as well as the development of social skills such as presentations. | 3 | GC2 |
| PP6302 | Industrial practice | The consolidation of theoretical knowledge and the acquisition of practical skills in enterprises. | 4 | PC2, PC3 |
| PP6303 | Industrial practice | Systematization, consolidation and expansion of theoretical knowledge, development of practical skills, mastery of the elements of independent practical and research work in enterprises. | 4 | PC2, PC3 |
| PP6304 | Pre-diploma practice | Search for information for writing the diploma project | 5 | BC2, PC1, PC2, PC3 |
| **3.2 Elective courses (EC)** | | | | |
| EEC6001 | Basic Circuit Theory | The course has been designed to introduce fundamental principles of circuit theory commonly used in engineering research and science applications. Techniques and principles of electrical circuit analysis including basic concepts such as voltage, current, resistance, impedance, Ohm's and Kirchoff's law; basic electric circuit analysis techniques, resistive circuits, 1st order and 2nd order circuits; circuits with DC and AC sources. | 4 | BC3 |
| SFT6320 | Microcontroller programming | The course teaches the skills of designing professionally-oriented information systems by type of software: technical, software, information; methods for the technical design of electronic devices based on microcontrollers; programming skills and microcontroller administration; skills of carrying out integration and modular testing of microcontroller scenarios. | 7 | BC3 |
| SFT6309 | UX/UI development | The course introduces students to the concept of designing systems that can effectively interact with people. Students will learn the principles of design and human behavior, as well as empirical research methods used to solve real problems in developing the interface. | 5 | PC2 |
| SFT6310 | Web-component development (Java EE) | Introduction to Java Enterprise Edition (J2EE) technology. Learning the basic concepts of developing enterprise dynamic web applications in the Java programming language with high performance. | | PC2, PC3 |
| NET6202 | Switching, Routing, and Wireless Essentials | The course is devoted to switching technologies and the operation of routers for small and medium-sized businesses. The course also includes topics such as | 6 | PC5 |

| | | | | |
|---|---|---|---|---|
| | | wireless LANs and security concepts. Students will be able to perform basic network settings and troubleshoot, identify and prevent local network security threats, and configure and protect the core WLAN. | | |
| NSA3 3308 | Design and simulation of electronic devices | The study of semiconductor materials, their characteristics, principles of operation and application. The physics of semiconductors, diodes of p-n junctions, heterojunctions, transistors, metal-semiconductor contacts are considered. | 5 | BC3 |
| EEC6004 | Fundamentals of logic design | Acquaintance, development and application of digital logic circuits, including combinational and sequential logic circuits. | 4 | BC3 |
| SFT6313 | Mobile technologies and applications (Android) | The purpose of the discipline "Mobile Technologies and Applications (Android)" is to teach students how to develop mobile applications for the Android platform. Upon completion of the course, students should be able to create functional and intuitive mobile applications using the Android toolkit. | 6 | PC2, PC3 |
| EEC6006 | Digital signal processing | The discipline studies basic methods and algorithms for digital signal processing and their computer modeling using the software package (MATLAB). The specifics of the representation of signals and digital signal processing systems in MATLAB are considered in detail. Linear discrete systems, the synthesis of digital filters and the modeling of these objects and processes using the MATLAB software are described. | 4 | PC6 |
| SFT6312 | Business component and Web-services development (Java EE) | The concepts of business components and web services, the search for differences between business logic and display logic, the distribution of tasks between the developer and Typesetter, training in working with a database connection, as well as object-relational mapping are considered. Topics include EJB3.0, Hibernate, JPA2.0, MDB technologies, writing business logic, identifying differences between web servers and application servers. | 5 | PC2, PC3 |
| NET6303 | Network programming | The study of network connectivity from local networks to the global Internet. We study standard problems and a number of solutions for each of them with special emphasis on the set of TCP / IP protocols. This course provides students with a working vocabulary, as well as the knowledge and skills necessary to implement, debug, and improve basic network applications. | 5 | PC5 |
| HRD6304 | Sensor technologies | Familiarity with the various types of sensors that are used for industrial automation, environmental assessment, as well as for human-computer interaction. | 6 | PC7 |
| NET6304 | Cloud Computing and Virtualization | Introductory course from Linux Foundation experts. Learning the basics of cloud computing, terminology, tools and technologies associated with modern cloud platforms. The course displays the entire cloudy landscape and explains how various tools and platforms interact with each other. | 5 | BC3 |
| MIN601 | Minor 1 | Additional educational program (minor) - a set of disciplines and (or) modules and other types of educational work, determined by students for study in order to form additional competencies | 5 | PC7 |
| MIN602 | Minor 2 | Additional educational program (minor) - a set of disciplines and (or) modules and other types of educational work, determined by students for study in order to form additional competencies | 5 | PC8 |

АО «МУИТ»

| SFT6319 | Blockchain technology | The Blockchain course is for those who want to learn more about blockchain technology and its applications. The course will look at how blockchain works, what its advantages and disadvantages are, what cryptocurrencies and tokens use blockchain, how to create and use smart contracts, and what are the examples of blockchain applications in various fields such as finance, logistics, medicine, etc. others | 4 | PC2, PC3 |
|---|---|---|---|---|
| MIN603 | Minor 3 | Additional educational program (minor) - a set of disciplines and (or) modules and other types of educational work, determined by students for study in order to form additional competencies | 4 | PC6 |
| NET6302 | Systems Administration | The course is based on the Linux operating system. It describes the architecture, components, file systems, regular expressions, user administration, access control, server configuration. | 5 | PC5 |
| NET6308 | Connecting Networks | This course focuses on the LAN and WAN technologies and network services required in a complex network. Students will be able to integrate several LAN technologies and protocols from previous networking courses, implement WAN interconnection, provide security solutions for IP networks, manage networks in a unified manner. | 7 | PC7 |
| SFT6315 | DevOps | The course examines the key concepts and principles of DevOps, organizational factors and automation tools in the development of software products using this method. | 7 | PC8 |
| **5 Final State Attestation:** | | | | |
| NZDP | Writing and defending a thesis, diploma project or preparing and passing a state exam | Writing and defending a thesis, diploma project or preparing and passing a state exam | 12 | |

# 5 Curriculum of the educational program

| № | Code | Subject | Total | STSH | SSH | Aud | PS | L | Lab | SP | Study language | Result control | 1 | 2 | Extra term |
|---|------|---------|-------|------|-----|-----|----|----|-----|----|----------------|----------------|---|---|------------|
| | | | | | Number of hours | | | Contact hours | | | | Study language | Result control | Distribution of credits per semester | | |
| | | | | | | | | | | | | | | Number of academic credits | Number of academic credits | Number of academic credits |
| | | **Core subjects** | | | | | | | | | | | | | | |
| 1 | LAN6001A | Foreign language | 150 | 15 | 90 | 45 | 45 | 0 | 0 | 0 | by student's option | exam. | 5 | | |
| 2 | ICT6001 | Information and Communication Technologies | 150 | 15 | 90 | 45 | 0 | 15 | 30 | 0 | by student's option | exam. | 5 | | |
| 3 | LAN6002A | Foreign language | 150 | 15 | 90 | 45 | 45 | 0 | 0 | 0 | by student's option | exam. | | 5 | |
| 4 | PhC6005 | Physical Culture | 120 | 15 | 60 | 45 | 45 | 0 | 0 | 0 | by student's option | exam. | | 4 | |
| | | **Catalogue of University disciplines** | | | | | | | | | | | | | | |
| 5 | MAT600** | Algebra and Geometry | 120 | 15 | 60 | 45 | 30 | 15 | 0 | 0 | by student's option | exam. | 4 | | |
| 6 | SFT6301 | Algorithmization and Programming | 180 | 15 | 105 | 60 | 15 | 15 | 30 | 0 | by student's option | exam. | 6 | | |
| 7 | SFT6305 | Database Design. Introduction to SQL | 120 | 15 | 60 | 45 | 0 | 15 | 30 | 0 | by student's option | exam. | 4 | | |
| 8 | NET6301 | Introduction to computer networks | 120 | 15 | 60 | 45 | 0 | 15 | 30 | 0 | by student's option | exam. | 4 | | |
| 9 | PHY6001 | Physics | 210 | 15 | 120 | 75 | 30 | 15 | 30 | 0 | by student's option | exam. | | 7 | |
| 10 | MAT6002 | Mathematical analysis | 180 | 15 | 105 | 60 | 30 | 30 | 0 | 0 | by student's option | exam. | | 6 | |
| 11 | PP6301 | Educational practice | 60 | 0 | 0 | 60 | 0 | 0 | 0 | 60 | by student's option | pract | | 2 | |
| 12 | SFT6304 | Programming in Python language | 120 | 15 | 60 | 45 | 0 | 15 | 30 | 0 | by student's option | exam. | | 4 | |
| 13 | SFT6306 | Software Architecture and Design | 120 | 15 | 60 | 45 | 0 | 15 | 30 | 0 | by student's option | exam. | | 4 | |
| | | Total: | 1800 | 180 | 960 | 660 | 240 | 150 | 210 | 60 | | | 28.0 | 32.0 | 0.0 |

| № | Code | Subject | Number of hours | | | | Contact hours | | | | Study language | Result control | Distribution of credits per semester | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total | STSH | SSH | Aud | PS | L | Lab | IWP | | | 1 | 2 | Extra term |
| | | | | | | | | | | | | | Number of academic credits | Number of academic credits | Number of academic credits |
| | | **Core subjects** | | | | | | | | | | | | | |
| 1 | LAN6001KR | Kazakh (Russian) language | 150 | 15 | 90 | 45 | 45 | 0 | 0 | 0 | by student's option | exam. | 5 | | |
| 2 | PhC6006 | Physical Culture | 120 | 15 | 60 | 45 | 45 | 0 | 0 | 0 | by student's option | exam. | 4 | | |
| 3 | HK6002 | History of Kazakhstan | 150 | 15 | 90 | 45 | 30 | 15 | 0 | 0 | by student's option | q exam | | 5 | |
| 4 | SPS6001 | Philosophy | 150 | 15 | 90 | 45 | 30 | 15 | 0 | 0 | by student's option | exam. | | 5 | |
| 5 | LAN6002KR | Kazakh (Russian) language | 150 | 15 | 90 | 45 | 45 | 0 | 0 | 0 | by student's option | exam. | | 5 | |
| | | **Catalogue of University disciplines** | | | | | | | | | | | | | |
| 6 | EEC6001 | Basic Circuit Theory | 120 | 15 | 60 | 45 | 0 | 15 | 30 | 0 | by student's option | exam. | 4 | | |
| 7 | MAT6005 | Discrete mathematics | 120 | 15 | 60 | 45 | 0 | 15 | 30 | 0 | by student's option | exam. | 4 | | |
| 8 | HRD3302 | Architecture and Organization of Computer Systems | 150 | 15 | 90 | 45 | 0 | 15 | 30 | 0 | by student's option | exam. | 5 | | |
| 9 | SFT6302 | Algorithms and Data Structures | 60 | 15 | 15 | 30 | 0 | 15 | 15 | 0 | by student's option | exam | 2 | | |
| 10 | EGR6302 | Information theory | 120 | 15 | 60 | 45 | 0 | 15 | 30 | 0 | by student's option | exam. | 4 | | |
| 11 | EGR6301 | Operating Systems | 150 | 15 | 60 | 45 | 0 | 15 | 30 | 0 | by student's option | exam. | | 5 | |
| 12 | EEC6004 | Fundamentals of Logic Design | 120 | 15 | 60 | 45 | 0 | 15 | 30 | 0 | by student's option | exam. | | 4 | |
| 13 | MAT6006 | Probability theory and mathematical statistics | 120 | 15 | 60 | 45 | 0 | 15 | 30 | 0 | by student's option | exam | | 4 | |
| 14 | PPS302 | Industrial practice | 120 | 0 | 0 | 120 | 0 | 0 | 0 | 120 | by student's option | pract. | | 4 | |
| 15 | | **Qualification examination** | | | | | | | | | | | | | |
| | | История Казахстана | | | | | | | | | | | | 5 | |
| | | Total: | 1800 | 195 | 915 | 690 | 195 | 150 | 225 | 120 | | | 28.0 | 32.0 | 0.0 |

| № | Code | Subject | Total | STGH | ESH | Aud | L | PS | Lab | WP | Study language | Result control | Number of academic credits 1 | Number of academic credits 2 | Extra term Number of academic credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Core subjects** | | | | | | | | | | | | | |
| 1 | SPS8106 | Psychology | 60 | 15 | 15 | 30 | 15 | 15 | 0 | 0 | by students option | exam | 2 | | |
| 2 | SPS8204 | Cultural studies | 60 | 15 | 15 | 30 | 15 | 15 | 0 | 0 | by students option | exam | 2 | | |
| 3 | SPS8002 | Political science | 60 | 15 | 15 | 30 | 15 | 15 | 0 | 0 | by students option | exam | | 2 | |
| 4 | SFS 6002 | Sociology | 60 | 15 | 15 | 30 | 15 | 15 | 0 | 0 | by students option | exam | | 2 | |
| | | **Catalogue of University disciplines** | | | | | | | | | | | | | |
| 5 | ECO8202 | Economics and organization of production | 150 | 15 | 90 | 45 | 15 | 30 | 0 | 0 | by students option | exam | | 5 | |
| 6 | LAN8007K | Business correspondence in the state language | 60 | 15 | 15 | 30 | 0 | 30 | 0 | 0 | by students option | exam | | 2 | |
| 7 | LAN8003PA | Professionally oriented foreign language | 120 | 15 | 60 | 45 | 0 | 45 | 0 | 0 | by students option | exam | 4 | | |
| 8 | PP8305 | Industrial practice | 120 | 0 | 0 | 120 | 0 | 0 | 0 | 120 | by students option | pract | | | 4 |
| | | **Electives** | | | | | | | | | | | | | |
| 9 | NET8202 | Switching, Routing and Wireless Essentials | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | by students option | exam | 6 | | |
| 10 | SFT8310 | Web-Component Development (Java EE) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | by students option | exam | | | |
| 11 | NET8302 | Systems Administration | 150 | 15 | 90 | 45 | 15 | 0 | 30 | 0 | by students option | exam | 5 | | |
| 12 | SFT8308 | UX/UI development | 120 | 15 | 60 | 45 | 15 | 0 | 30 | 0 | by students option | exam | | | |
| 13 | HRC8304 | Sensor Technologies | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | by students option | exam | 6 | | |
| 14 | NET8306 | DevNet | 180 | 15 | 105 | 60 | 15 | 30 | 0 | 0 | by students option | exam | | | |
| 15 | SFT8313 | Mobile technologies and applications (Android) | 180 | 15 | 105 | 60 | 15 | 30 | 0 | 0 | by students option | exam | | | |
| 16 | MIN8601 | Minor 1 | 150 | 15 | 75 | 60 | 15 | 0 | 30 | 0 | by students option | exam | | 5 | |
| 17 | NET8302 | Network programming | 150 | 15 | 90 | 45 | 15 | 0 | 30 | 0 | by students option | exam | | | |
| 18 | SFT8312 | Business Component and Web-services Development (Java EE) | 180 | 15 | 105 | 60 | 15 | 15 | 30 | 0 | by students option | exam | | | |
| 19 | NET8304 | Cloud Computing and Virtualization | 150 | 15 | 90 | 45 | 15 | 0 | 30 | 0 | by students option | exam | | 5 | |
| 20 | EEC8002 | Design and simulation of electronic devices | 120 | 15 | 60 | 45 | 15 | 0 | 30 | 0 | by students option | exam | | | |
| 21 | MIN8602 | Minor 2 | 150 | 15 | 75 | 60 | 15 | 15 | 30 | 0 | by students option | exam | | 5 | |
| | | Total | 2220 | 255 | 1080 | 885 | 225 | 240 | 300 | 120 | | | 30.0 | 30.0 | 0.0 |

| № | Code | Subject | Number of hours | | | | | Contact hours | | | | Study language | Result control | Distribution of credits per semester | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total | ST | SH | SSH | Aud | L | PS | Lab | UGP | | | Number of academic credits | Number of academic credits | Extra term |
| | | | | | | | | | | | | | | 1 | 2 | |
| | | Catalogue of University disciplines | | | | | | | | | | | | | | |
| 1 | SEC8301 | Fundamentals of information security | 120 | 15 | 80 | 45 | 15 | 15 | 0 | 30 | 0 | by student's option | exam | 4 | | |
| 2 | RM8301 | Research fundamentals | 120 | 15 | 60 | 45 | 15 | 15 | 30 | 0 | 0 | by student's option | t.w. | 4 | | |
| 3 | EEC6008 | Digital signal processing | 120 | 15 | 45 | 60 | 15 | 15 | 15 | 30 | 0 | by student's option | exam | 4 | | |
| 4 | SFT8319 | Blockchain technology | 180 | 15 | 105 | 60 | 15 | 15 | 15 | 30 | 0 | by student's option | exam | 6 | | |
| 5 | SFT8320 | Microcontroller programming | 210 | 15 | 120 | 75 | 15 | 15 | 30 | 30 | 0 | by student's option | exam | 7 | | |
| 6 | SFT8308 | System Level Programming | 180 | 15 | 105 | 60 | 15 | 15 | 15 | 30 | 0 | by student's option | exam | 6 | | |
| 7 | RM8301 | Project management | 120 | 15 | 60 | 45 | 15 | 15 | 15 | 30 | 0 | by student's option | exam | | 4 | |
| 8 | PPO304 | Pre-diploma practice | 150 | 0 | 0 | 150 | 0 | 0 | 0 | 0 | 150 | by student's option | pract | | 5 | |
| | | Electives | | | | | | | | | | | | | | |
| 9 | NET8308 | Connecting Networks | 210 | 15 | 120 | 75 | 15 | 15 | 30 | 30 | 0 | by student's option | exam | 7 | | |
| 10 | SFT8315 | DevOps | 210 | 15 | 120 | 75 | 15 | 15 | 30 | 30 | 0 | by student's option | exam | | | |
| 11 | MIN803 | Minor 3 | 150 | 15 | 75 | 60 | 15 | 15 | 15 | 30 | 0 | by student's option | exam | 5 | | |
| | | Qualification examination | | | | | | | | | | | | | | |
| 12 | | Diploma thesis project | | | | | | | | | | | | | 8 | |
| | | Total: | 1770 | 150 | 870 | 750 | 150 | 150 | 180 | 270 | 150 | | | 43.0 | 17.0 | 0.0 |

## 6 Developer approval sheet

The title of the educational program: 6B06106 «Computer Systems and Software Engineering»

| №<br>п/п | Position, degree, last name and initials of a<br>developer of the educational program | Date | Signature | Note |
|---|---|---|---|---|
| 1 | PhD, head of the «CE» department, ass professor T.T. Chinibayeva | 30.03.2023 | | |
| 2 | MSc, senior-lector of the «CEIS» department Tokanov O.S.. | 30.03.2023 | | |