



KAZAKH NATIONAL WOMEN'S TEACHER TRAINING UNIVERSITY  
HIGHER SCHOOL OF PHYSICS, MATHEMATICS AND DIGITAL TECHNOLOGIES  
6B01506-Computer Science  
Catalog of elective disciplines

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**EDUCATIONAL PROGRAMME: 6B01506-Computer Science**

**1. OPTIONAL COMPONENTS OF THE CYCLE OF GENERAL COURSES**

*Optional component 1*

**Course: Fundamentals of Legal Literacy and Anti-Corruption culture**

*Intensity of the Course:* 5 academic credits

*Module Code:* **GES -1**

*Module Name:* General educational subjects module

*Prerequisites:* Basics Law (school cours)

*Purpose:* formation of a legally competent, law-abiding person who knows his rights and duties, intolerant of any manifestations of corruption.

*Short Description:* The course is aimed at the formation of a legally competent, law-abiding person who knows his rights and obligations, intolerant of any manifestations of corruption. Students will be able to operate with the social, legal and ethical norms of Kazakhstani society.

*Learning Outcomes in EP (LOP):*

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems.

LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

*Learning Outcomes in Course (LOC):*

LOC 1 - To know the importance and role of legal culture in the life of society, its relationship with the political culture of the individual and the main definitions of corruption;

LOC 2 - Analyze the main obstacles on the way to ensuring the inalienable human rights; the role of human rights in personal life and in the life of society;

LOC 3 - Apply the acquired knowledge in political analysis, in the activities of public authorities, political and public organizations, analyze problems related to corruption and countering it;

LOC 4 - Be able to engage in dialogue as a way of relating to legal culture and society.

*Post requisites:* no

*Optional component 1*

**Course: Fundamentals of Ecology and Safe life**

*Intensity of the Course:* 5 academic credits

*Module Code:* **GES -1**

*Module Name:* General educational subjects module

*Prerequisites:* Biology, Geography (school program)

*Purpose:* maintaining the stability of life by analyzing environmental processes, forming priority areas and setting specific tasks for nature conservation.

*Short Description:* The discipline forms students' modern environmental education and culture, develops skills in applying methods to improve the safety of technical means and technological processes for safe life. Reveals the basic laws of the functioning of ecosystems of various levels of organization, the biosphere as a whole, the contradictions that arise in the relationship between man and nature, as well as the need for respect for nature and ecology.

*Learning Outcomes in EP (LOP):*

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems.

LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

*Learning Outcomes in Course (LOC):*

LOC 1 - Knows the terms and concepts that define the main features and features of ecosystems;

LOC 2 - Has an idea of the complex relationships taking place in nature, as well as between society and nature;



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LOC 3 - Can give an environmental assessment of the situation in the region and promote the knowledge gained as a result of work in all areas of its activities;

LOC 4 - It can analyze the main legislative documents on environmental safety and modern environmental problems.

*Post requisites:* no

*Optional component 1*

**Course: Fundamentals of Economics and Entrepreneurship**

*Intensity of the Course:* 5 academic credits

*Module Code:* **GES -1**

*Module Name:* General educational subjects module

*Prerequisites:* Fundamentals of Entrepreneurship and business (school course)

*Purpose:* familiarization of students with the basics of economics and entrepreneurship, mastering the conceptual apparatus and basic forms of doing business.

*Short Description:* The discipline is focused on the formation of students' skills of entrepreneurship and business thinking. Through a comprehensive view of the laws of the functioning of the economy, the conditions for doing business, its internal and external environment, students will have the skills to develop a business plan, create and successfully run their own business.

*Learning Outcomes in EP (LOP):*

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems.

LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

*Learning Outcomes in Course (LOC):*

LOC 1 - Know the basic concepts in the field of economics and entrepreneurship;

LOC 2 - Be able to find and use the necessary economic information; determine the organizational and legal forms of organizations;

LOC 3 - Determine the composition of the material, labor and financial resources of the organization;

LOC 4 - Evaluation of a business idea and development of a business plan.

*Post requisites:* no

*Optional component 1*

**Course: Fundamentals of Leadership and receptivity to innovation**

*Intensity of the Course:* 5 academic credits

*Module Code:* **GES -1**

*Module Name:* General educational subjects module

*Prerequisites:* no

*Purpose:* in the process of studying the discipline, the student develops the skills of setting goals and objectives, timely planning of group work, problem solving, a sense of responsibility and effective communication.

*Short Description:* The course contributes to the disclosure and development of leadership qualities in the personality of each student, the development of innovative susceptibility skills in him, as a process of adaptation to innovations caused by innovative processes, as well as the use of the results of scientific and technical processes in his life and professional activities. Studies the current state and prospects for the development of leadership qualities and the human factor in management.

*Learning Outcomes in EP (LOP):*

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems.

LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.



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*Learning Outcomes in Course (LOC):*

LOC 1 - Understands theoretical and applied research in the field of modern management achievements in Kazakhstan and abroad using modern scientific methods;

LOC 2 - Knows how to work effectively individually and in a team;

LOC 3 - Independently study and continuously improve their qualifications throughout the entire period of professional activity;

LOC 4 - Applies professional knowledge in the field of organizational and managerial activities.

*Post requisites:* no

*Optional component 1*

**Course: Emotional Intellect**

*Intensity of the Course:* 5 academic credits

*Module Code:* **GES -1**

*Module Name:* General educational subjects module

*Prerequisites:* no

*Purpose:* knowledge and ability to apply modern methods of diagnostics and development of emotional intelligence of students and soft skills, including in the format of distance learning.

*Short Description:* The discipline is aimed at mastering the role of a tutor by the teacher in the context of strategic guidelines and priority areas of the state educational policy of Kazakhstan. Students determine the place of emotional intelligence and "flexible competencies" in the educational process of the modern school. They apply modern methods and technologies for organizing educational activities, taking into account the development of soft skills, including in the digital environment. They possess technologies for assessing and developing the emotional intelligence of students of different age groups.

*Learning Outcomes in EP (LOP):*

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems.

LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

*Learning Outcomes in Course (LOC):*

LOC 1 - Modern methods and technologies of organizing educational activities taking into account the development of soft skills, diagnostics and evaluation of flexible skills, the formation of individual educational directions and methods of organizing group activities;

LOC 2 - Application of modern methods and technologies for organizing educational activities, taking into account the development of flexible skills, including in the digital environment;

LOC 3 - Flexible skills on the skillfolio platform have the ability to carry out complex diagnostics of soft skills, interpret the results and develop them both in individual and group forms of training.

*Post requisites:* no

*Optional component 1*

**Course: Fundamentals of mathematical statistics**

*Intensity of the Course:* 5 academic credits

*Module Code:* **GES -1**

*Module Name:* General educational subjects module

*Prerequisites:* Mathematics (school programme)

*Purpose:* is to familiarize students with the forms and laws of consistent thinking, to teach students to think consistently, to contribute to the development of skills of sound argumentation.

*Short Description:* Students understand the process of collecting, processing data and transmitting ideas, develop skills in using quantitative and qualitative data analysis in assessing the state of the object or phenomenon in question.

*Learning Outcomes in EP (LOP):*

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems.



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LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

*Learning Outcomes in Course (LOC):*

LOC 1 - The student summarizes the results of pedagogical and scientific research and learns to process them mathematically.

LOC 2 - Learns to systematize, clarify and use statistical data using statistical and mathematical methods.

LOC 3 - Effectively uses Chi-square, SSPP and Jamovi applications that statistically process the collected numbers.

*Post requisites:* no

## 2. OPTIONAL COMPONENTS OF THE CYCLE OF CORE COURSES

### *Optional component 1*

**Course: Computer Architecture and Operating Systems**

*Intensity of the Course:* 6 academic credits

*Module Code:* **FP-5**

*Module Name:* Fundamental training

*Prerequisites:* Computer Science (school course)

*Purpose:* the study of the basic concepts of the architecture of a personal computer, the device and the principle of operation of the most important components of the hardware and software of a personal computer, the mechanisms of transmission and management of information. And also to give a systematic idea of the principles of the construction and functioning of operating systems.

*Short Description:* The course covers computer architecture and types of operating systems. In this course, students will learn how to assemble a computer and motherboard, connect cables, install an operating system, allocate memory, remove an operating system, master operating system concepts and functions such as process, memory, and file system management, and understand how operating systems enable interaction between hardware and software applications.

*Learning Outcomes in EP (LOP):*

LOP 5 – – Demonstrates knowledge and understanding of computer hardware and system software, computer architecture.

LOP 6 – Designs an information system in accordance with the task and provides data protection in computer systems and networks, as well as creates algorithms for artificial intelligence management.

*Learning Outcomes in Course (LOC):*

LOC 1 – uses interdisciplinary knowledge to solve applied problems;

LOC 2 – classifies computers according to various characteristics, characteristics and features of various classes of computer;

LOC 3 – knows the basic principles of architecture used in building a computer, hardware and system configuration of the computer;

LOC 4 – has knowledge of the basic concepts, functions, compositions and principles of operating systems; architecture of modern operating systems.

*Post requisites:* no.

### *Optional component 1*

**Discipline: Computer Hardware**

*Intensity of the Course:* 6 academic credits

*Module Code:* **FT-5**

*Module Name:* Fundamental Training

*Prerequisites:* Informatics (school course)

*Purpose:* teaching students the basic concepts of the architecture of a modern computer, the device and the principle of operation of its most important components, and ways of programming computer hardware.

*Short description:* In the course of studying the discipline, students should gain systematic knowledge about the architecture of computer systems, the organization and basic principles of modern computers, as well as an understanding of the interaction of their hardware and software. By studying the discipline, students develop the skills of working on a personal computer, self-maintenance of a computer.

*Learning Outcomes in EP (LOP):*



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LOP 5 – Demonstrates knowledge and understanding of computer hardware and system software, computer architecture.

LOP 6 – Designs an information system in accordance with the task and provides data protection in computer systems and networks, as well as creates algorithms for artificial intelligence management.

*Learning Outcomes in Course (LOC):*

LOC 1 - knows the composition, organization and principles of operation of the main components of the system software;

LOC 2 - has knowledge and understanding of the variety of physical and software organization of data input and output;

LOC 3 - evaluates and uses the capabilities of operating systems, file systems, and programming automation systems.

*Post requisites:* no.

*Optional component 2*

**Discipline: Programming of Mobile Devices**

*Intensity of the Course:* 5 academic credits

*Module Code:* TP-6

*Module Name:* Programming Technologies

*Prerequisites:* Computer game programming

*Purpose:* studying the basic device of popular mobile platforms and the capabilities that this platform provides for the development of mobile systems based on emulators, obtaining practical skills in creating user interfaces and mobile applications.

*Short description:* The course is aimed at deepening knowledge about the principles of building mobile and embedded operating systems, application development technologies for mobile devices, developing and improving students' skills and abilities to use tools for developing applications running on mobile and embedded operating systems such as Android and iOS, platforms and languages for developing mobile applications.

*Learning Outcomes in EP (LOP):*

LOP 7 – Creates algorithms and develops computer programs, interface design and mobile applications for solving applied problems, including those related to robotics programming in education.

LOP 8 - Applies the theory of computer science, applied knowledge of mathematics, computer and mathematical modeling programs in professional teaching activities.

*Learning Outcomes in Course (LOC):*

LOC 1 – uses subject and interdisciplinary knowledge to solve applied problems;

LOC 2 – knows the principles and technologies of mobile application development;

LOC 3 – applies the basic methods and tools of software development, collection, processing and interpretation of modern scientific research data;

LOC 4 – develops mobile applications on iOS and Android platforms.

*Post requisites:* Cloud technologies, Programming of Olympiad tasks.

*Optional component 2*

**Discipline: Mobile Programming Technologies and Augmented Reality**

*Intensity of the Course:* 5 academic credits

*Module Code:* TP-6

*Module Name:* Programming Technologies

*Prerequisites:* Computer game programming

*Purpose:* theoretical and practical training of students in the field of software development for mobile devices using various modern programming languages.

*Short description:* Formation of students' basic skills in creating their own mobile applications in various mobile operating systems by mastering 3D graphics and animation, virtual, augmented and mixed reality technologies. Students should apply their knowledge when designing VR systems, import 3D models into the VR/AR development environment, develop and debug effective algorithms for developing mobile applications.

*Learning Outcomes in EP (LOP):*

LOP 6 – Designs an information system in accordance with the task and provides data protection in computer systems and networks, as well as creates algorithms for artificial intelligence management.

LOP 7 – Creates algorithms and develops computer programs, interface design and mobile applications for solving applied problems, including those related to robotics programming in education.



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*Learning Outcomes in Course (LOC):*

LOC 1 – uses subject and interdisciplinary knowledge to solve applied problems;

LOC 2 – knows the principles and technologies of developing a mobile application and an augmented reality application;

LOC 3 – applies the basic methods and tools of software development, collection, processing and interpretation of modern scientific research data;

LOC 4 – develops mobile and augmented reality applications.

*Post requisites:* Cloud technologies, Programming of Olympiad tasks.

*Optional component 3*

**Discipline: Computer Networks**

*Intensity of the Course:* 5 academic credits

*Module code:* **NTDP-7**

*Module name:* Network Technologies and Data Processing

*Prerequisites:* Information and Communication Technologies.

*Purpose:* The aim of the course is to form students with the necessary amount of theoretical and practical knowledge about the principles of functioning and construction of computer networks.

*Short description:* The aim of the course is to form the necessary amount of theoretical and practical knowledge of the principles of the functioning and construction of computer networks. The content of the course deals with the functionality of communication equipment, the appointment of protocols and data transmission technology in networks, computer configuration, and troubleshooting of computer networks.

*Learning Outcomes in EP (LOP):*

LOP 6 – Designs an information system in accordance with the task and provides data protection in computer systems and networks, as well as creates algorithms for artificial intelligence management

LOP 10 – Demonstrates knowledge on storage, search, processing of graphic information, develops methods of database design and algorithm analysis.

*Learning Outcomes in Course (LOC):*

LOC 1 - knows about the basic terms and concepts of the architecture of computer networks, about methods of constructing and analyzing the effectiveness of using computer networks;

LOC 2 - applies techniques for working in computer networks and cloud services;

LOC 3 - organizes and configures computer networks;

LOC 4 - analyzes models of computer networks and cloud technologies;

LOC 5 - uses hardware and software components of computer networks in solving various problems.

*Post requisites:* Web technologies, IoT Technologies.

*Optional component 3*

**Discipline: Cloud Technologies**

*Intensity of the Course:* 5 academic credits

*Module code:* **NTDP-7**

*Module name:* Network Technologies and Data Processing

*Prerequisites:* Information and Communication Technologies

*Purpose:* students study the architecture of "cloud" technologies, methods and features of designing "cloud" services.

*Short description:* The course aims to form students with the necessary amount of theoretical and practical knowledge about cloud computing technology, skills and practical implementation of cloud technologies, the study of the tools of this technology. During the course, students will master the technologies of creating a cloud service, work with existing cloud services, students will learn how to use cloud computing and will be ready to use cloud computing technology in solving IT process optimization problems.

*Learning Outcomes in EP (LOP):*

LOP 3 – Demonstrate knowledge and compliance with ethical and legal norms in research and the use of digital technologies. Apply security measures when working with digital information and data protection, promote active, safe and ethical use of digital resources.

LOP 4 - Applies subject and interdisciplinary knowledge to carry out scientific and practical research work.

*Learning Outcomes in Course (LOC):*

LOC 1 - knows about the basic terms and concepts of cloud technologies, about methods of constructing and analyzing the effectiveness of cloud technologies;



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- LOC 2 - applies techniques of working in cloud services;
  - LOC 3 - organizes and configures computer networks;
  - LOC 4 - analyzes cloud technology models;
  - LOC 5 - uses hardware and software components of computer networks to solve various tasks.
- Post requisites:* Web technologies, IoT Technologies.

*Optional component 4*

**Discipline: Working with databases in Python**

*Intensity of the Course:* 5 academic credits

*Module code:* **NTDP-7**

*Module name:* Network Technologies and Data Processing

*Prerequisites:* Object Oriented Programming.

*Purpose:* to develop students' skills in using the operations of creating, reading, editing and deleting when working with databases, using Python libraries to work with SQL databases, developing applications for different databases.

*Short description:* This course covers the basics of structured query language (SQL) and database design as a separate stage in the process of data collection, analysis and processing. Students will learn how to use create, read, edit and delete operations when working with databases, connect to various databases using Python libraries to work with SQL databases, manage SQLite, MySQL databases, perform database queries inside Python applications, develop applications for different databases.

*Learning Outcomes in EP (LOP):*

LOP 3 Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

LOP 6 - Designs an information system in accordance with the task and provides data protection in computer systems and networks, as well as creates algorithms for artificial intelligence management.

LOP 10 - Demonstrates knowledge on storage, search, processing of graphic information, develops methods of database design and algorithm analysis.

*Learning Outcomes in Course (LOC):*

LOC 1 - knows the basic concepts and principles of database creation;

LOC 2 - knows the principles of storing data in multiple tables as part of a database;

LOC 3 - has the skills to use the operations of creating, reading, editing and deleting when working with databases;

LOC 4 - has design skills.

*Post requisites:* BigData.

*Optional component 4*

**Discipline: BigData**

*Intensity of the Course:* 5 academic credits

*Module Code:* **NTDP-7**

*Module Name:* Network technologies and data processing

*Prerequisites:* Module "Fundamentals of Algorithms and programming" (Programming)

*Purpose:* formation of theoretical knowledge and practical skills in the field of methodology, processing and analysis of big data.

*Short description:* The study of the discipline is the study of methods and approaches to data analysis of various volumes, including data preprocessing and statistical analysis, the development of various machine learning models for solving clustering, classification and regression problems and their application to solve applied problems in various fields of human activity. During the development of this course, the student must: study data and knowledge models, the processes of creation, accumulation and processing of information, including their description, analysis and creation.

*Learning Outcomes in EP (LOP):*

LOP 3 Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

LOP 6 - Designs an information system in accordance with the task and provides data protection in computer systems and networks, as well as creates algorithms for artificial intelligence management.

LOP 10 - Demonstrates knowledge on storage, search, processing of graphic information, develops methods of database design and algorithm analysis.





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*Learning Outcomes in Course (LOC):*

LOC 1 – knows the basic concepts and principles of Big Data technology;

LOC 2 – defines arrays of big data;

LOC 3– Analyzes big data clusters;

LOC 4 – has the skills to work with hardware and software for processing big data.

*Post requisites:* Cybersecurity, Program and Data security.

*Optional component 5*

**Discipline: Web technologies**

*Intensity of the Course:* 6 academic credits

*Module code:* **NTDP-7**

*Module name:* Network technologies and Information systems

*Prerequisites:* Computer Networks, Cloud Technologies.

*Purpose:* the study of modern web technologies and tools for the creation, support and management of web resources, the acquisition of skills and abilities to use modern tools in practice.

*Short description:* In the course, students will get acquainted with the basics of web application development. The main development language will be JavaScript, PHP, HTML and CSS.

*Learning Outcomes in EP (LOP):*

LOP 5 – Demonstrates knowledge and understanding of computer hardware and system software, computer architecture.

LOP 7 – Creates algorithms and develops computer programs, interface design and mobile applications for solving applied problems, including those related to robotics programming in education.

*Learning Outcomes in Course (LOC):*

LOC 1 - solves applied problems using information and communication technologies;

LOC 2 - knows the basics of website design and design technology and the main approaches to the development of web applications;

LOC 3 - programs sites with various software tools;

LOC 4 - has practical skills in creating, debugging and deploying web applications using various programming systems.

*Post requisites:* no.

*Optional component 5*

**Discipline: IoT Technologies**

*Intensity of the Course:* 6 academic credits

*Module code:* **NTDP-7**

*Module name:* Network technologies and Information systems

*Prerequisites:* Computer Networks, Cloud Technologies.

*Purpose:* The purpose of this course is to introduce students to the basic principles of connections. a new technological concept of the Internet of Things IoT.

*Short description:* The purpose of this course is to introduce students to the basic principles of connectivity. the new technological concept of the Internet of Things IoT. The course deals with the concept of connecting people, processes, data and things in order to increase the efficiency and value of network connections. Students learn to understand existing IoT technologies and apply them in practice.

*Learning Outcomes in EP (LOP):*

LOP5 - Demonstrates knowledge and understanding of computer hardware and system software, computer architecture.

LOP 6 - Acquires knowledge of storing, searching, processing and protecting information in information systems and computer network Designs an information system in accordance with the task and provides data protection in computer systems and networks, as well as creates algorithms for artificial intelligence management s.

LOP 10 - Demonstrates knowledge on storage, search, processing of graphic information, develops methods of database design and algorithm analysis.

*Learning Outcomes in Course (LOC):*

LOC 1 - knows the principles of the organization and functioning of the 'Internet of Things';

LOC 2 - works with microcontrollers and main debugging boards (Arduino and Raspberry Pi)



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LOC 3 - understands existing IoT technologies and applies them to specific scenarios;

LOC 4 - designs integrated IoT systems (including end devices, network connection, data exchange, cloud platforms, data analysis).

*Post requisites:* no.

*Optional component 6*

**Discipline: Computer Graphics**

*Intensity of the Course:* 6 academic credits

*Module code:* **SE-8**

*Module name:* STEM-Education

*Prerequisites:* Information and Communication Technologies

*Purpose:* mastering the graphic tools of computer programs, studying the principles, means and techniques of graphic design and 3D printing.

*Short description:* The course is aimed at studying methods and means of computer graphics, types of graphics, algorithmic and mathematical foundations of computer graphics construction. During the course, students develop practical skills in working with raster, two-dimensional and three-dimensional vector graphics software, students learn to use the basic functionality of modern graphics systems, students develop skills in creating and editing images in specialized software.

*Learning Outcomes in EP (LOP):*

LOP 7 – Creates algorithms and develops computer programs, interface design and mobile applications for solving applied problems, including those related to robotics programming in the field of education.

LOP -10 – Demonstrates knowledge on storage, search, processing of graphic information, develops methods of database design and algorithm analysis.

*Learning Outcomes in Course (LOC):*

LOC 1 - knows the principles, techniques and means of graphic design of projects;

LOC 2 - owns modern software and hardware for graphic design and 3D printing;

LOC 3 - works with graphic libraries when programming in high-level languages;

LOC 4 - possesses the skills of visual presentation of information including 3D models of objects.

*Post requisites:* no.

*Optional component 6*

**Discipline: Methodology of Development Interactive Interface**

*Intensity of the Course:* 5 academic credits

*Module Code:* **SE-8**

*Module Name:* STEM-Education

*Prerequisites:* Information and Communication Technologies.

*Purpose:* To form an idea of technical and software tools for the implementation of competencies in the field of creating an interactive interface using modern software, as well as user interface development skills. Master the methodology of creating an interactive interface.

*Short description:* This course covers user interface development using modern software, as well as user interface development skills. Students have the skills of using electronic educational resources on interactive interface design, developing interface design, writing a description of the interactive interface development process, creating visual components of the user interface, justifying the interface design solution based on the principles of ergonomics and design trends.

*Learning Outcomes in EP (LOP):*

LOP 7 – Creates algorithms and develops computer programs, interface design and mobile applications for solving applied problems, including those related to robotics programming in the field of education.

LOP 10 – Demonstrates knowledge on storage, search, processing of graphic information, develops methods of database design and algorithm analysis.

*Learning Outcomes in Course (LOC):*

LOC 1 – is able to analyze professional experience in developing interactive interfaces using information and communication technologies;

LOC 2 – is able to conduct testing using an interactive interface;

LOC 3 – compiles technical documentation and develops a design solution for the interface;

LOC 4 – develops interactive interface design projects.

*Post requisites:* no.



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*Optional component 7*

**Course: Introduction to Artificial Intelligence**

*Intensity of the Course:* 5 academic credits

*Module Code:* **SE-8**

*Module Name:* STEM-Education

*Prerequisites:* Information and Communication Technologies.

*Purpose:* Familiarization of students with the concept of artificial intelligence. Training in the fields of application and features of the use of artificial intelligence. Teaching techniques of programming elements of artificial intelligence.

*Short Description:* The course covers the main areas of work in the field of artificial intelligence, the syntax of the programming language for artificial intelligence, the features of knowledge and models of their representation, methods of development and creation of expert systems. After completing the course, students will be guided in approaches to the creation of artificial intelligence systems: knowledge-based, oriented in the algorithmic foundations of intelligent systems, as well as the design of complex information systems using artificial intelligence.

*Learning Outcomes in EP (LOP):*

LOP 4 – Applies subject and interdisciplinary knowledge to carry out scientific and practical research work.

LOP 6 – Designs an information system in accordance with the task and provides data protection in computer systems and networks, as well as creates algorithms for artificial intelligence management.

*Learning Outcomes in Course (LOC):*

LOC 1 – creates image recognition tasks (for example: natural voice recognition) based on artificial intelligence systems;

LOC 2 – argues theorems and solves applied problems;

LOC 3 – creates expert systems-software systems that can make decisions as experts.

*Post requisites:* Educational Robotics.

*Optional component 7*

**Course: Fundamentals of intelligent systems**

*Intensity of the Course:* 5 academic credits

*Module Code:* **SE-8**

*Module Name:* STEM-Education

*Prerequisites:* Information and Communication Technologies.

*Purpose:* The course introduces students to the concept of immersive technology, the generalized name of devices offering and providing a virtual reality environment (Virtual reality), Mixed MR (Mixed reality) or augmented reality AR (Augmented reality); gets acquainted with the concepts underlying the understanding of modern achievements of immersive technologies and working with programs offering a virtual, mixed or augmented reality environment. augmented reality..

*Short Description:* The purpose of this discipline is to give a systematic overview of modern models of knowledge representation, to study and master the principles of building intelligent systems, to consider promising areas of systems development. Students gain theoretical and practical knowledge and skills in using modern artificial intelligence systems, neural network technologies for information processing in teaching intelligent systems at school.

*Learning Outcomes in EP (LOP):*

LOP 3 – Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

LOP 4 – Applies subject and interdisciplinary knowledge to carry out scientific and practical research work.

LOP 10 - Demonstrates knowledge on storage, search, processing of graphic information, develops methods of database design and algorithm analysis.

*Learning Outcomes in Course (LOC):*

LOC 1 – understands and uses methods with artificial intelligence concepts;

LOC 2 – uses the hardware of intelligent measurement systems.

*Post requisites:* Educational Robotics.



### 3. OPTIONAL COMPONENTS OF THE CYCLE OF MAJOR DISCIPLINES

#### *Optional component 1*

**Discipline: Immersive Technologies**

*Intensity of the Course:* 6 academic credits

*Module Code:* SE-8

*Module Name:* STEM-Education

*Prerequisites:* Information and Communication Technologies.

*Purpose:* to form an idea of the use of immersive information technology in educational activities.

*Short description:* The course introduces students to the concept of immersive technology, the generalized name of devices offering and providing a virtual reality environment (Virtual reality), mixed MR (Mixed reality) or augmented reality AR (Augmented reality); gets acquainted with the concepts underlying the understanding of modern achievements of immersive technologies and working with programs offering a virtual reality environment, mixed or augmented reality.

*Learning Outcomes in EP (LOP):*

LOP 3 – Demonstrate knowledge and compliance with ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote active, safe and ethical use of digital resources.

LOP 4 – Applies subject and interdisciplinary knowledge to carry out scientific and practical research work.

LOP 10 – Demonstrates knowledge on storage, search, processing of graphic information, develops methods of database design and algorithm analysis.

*Learning Outcomes in Course (LOC):*

LOC 1 – concept, classifications, possibilities of immersive technologies, applications of virtual reality systems;

LOC 2 – independently analyze the practices of using immersive information technologies in education;

LOC 3 – develop simple electronic resources in augmented and virtual reality;

LOC 4 is a methodology for the use of immersive information technologies in the educational process.

*Post requisites:* no.

#### *Optional component 1*

**Discipline: Digital Technologies in Education**

*Intensity of the Course:* 6 academic credits

*Module Code:* SE-8

*Module Name:* STEM-Education

*Prerequisites:* Information and Communication Technologies.

*Purpose:* aimed at the formation of skills in the use of digital technologies for the organization of the educational process and the development of methodological materials.

*Short description:* A practical course aimed at developing skills in the use of digital technologies for the organization of the educational process and the development of methodological materials. The course develops students' skills in digital programs and technical means in all areas of digitalization of education: in management and educational institutions, computer programs, digital learning technologies; didactic ICT capabilities, virtual secondary and distance learning technologies.

*Learning Outcomes in EP (LOP):*

LOP 3 – Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources

LOP 4 – Applies subject and interdisciplinary knowledge to carry out scientific and practical research work.

*Learning Outcomes in Course (LOC):*

LOC 1 - mastery of the skills of modern digital technology services (including artificial intelligence);

LOC 2 - gaining experience in using the capabilities of the information and educational environment, modern tools and services of modern digital technologies in professional activities;

LOC 3 - implementation of evaluation activities and monitoring of the educational process using modern digital tools.

*Post requisites:* no.

#### *Optional component 2*

**Discipline: Cybersecurity**

*Intensity of the Course:* 5 academic credits



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*Module Code:* **NTDP-7**

*Module Name:* Network technologies and Data processing

*Prerequisites:* Computer networks

*Purpose:* To study the theoretical foundations of information protection in computer systems and networks, databases, basic data protection algorithms, methods of organizing data protection and processing, software and information protection and data storage, principles of building security systems and their application in modern information systems.

*Short description:* The purpose of the discipline is to lay down a methodology for ensuring cybersecurity of information systems and information resources used in professional activities. Students study the structure of the information security system, the basic standards for information security management, the study of theoretical, methodological and practical problems in the field of cybersecurity.

*Learning Outcome s in EP (LOP):*

LOP 5 – Demonstrates knowledge and understanding of computer hardware and system software, computer architecture.

LOP 6 – Designs an information system in accordance with the task and provides data protection in computer systems and networks, as well as creates algorithms for artificial intelligence management.

LOP 10 – Demonstrates knowledge on storage, search, processing of graphic information, develops methods of database design and algorithm analysis.

*Learning Outcomes in Course (LOC):*

LOC 1 – knows how to choose security systems and apply design principles in practice;

LOC 2 – designs and develops an organization's information security management system to ensure security;

LOC 3 – is able to determine security conditions, execute security algorithms.

*Post requisites:* no.

*Optional component 2*

*Discipline:* **Software and Data Security**

*Intensity of the Course:* 5 academic credits

*Module Code:* **NTDP-7**

*Module Name:* Network technologies and Data processing

*Prerequisites:* Computer networks

*Purpose:* development of projects of systems and subsystems for the protection of programs and data in accordance with the terms of reference.

*Short description:* This course covers basic encryption methods, basic algorithms used in cryptosystems, and measures taken to improve program and data security. Students will learn how to use cryptographic protocols to solve practical problems, detect, fix, and prevent vulnerabilities in computer networks, and identify vulnerabilities at different stages of the software life cycle.

*Learning Outcomes in EP (LOP):*

LOP 5 – Demonstrates knowledge and understanding of computer hardware and system software, computer architecture.

LOP 6 – Designs an information system in accordance with the task and provides data protection in computer systems and networks, as well as creates algorithms for artificial intelligence management.

LOP 10 – Demonstrates knowledge on storage, search, processing of graphic information, develops methods of database design and algorithm analysis.

*Learning Outcomes in Course (LOC):*

LOC 1 – Knows the requirements for the audit subsystem and audit policy; protective mechanisms and means to ensure the security of programs and data

LOC 2 - Implements measures to counter security breaches using various software and hardware protection tools.

LOC 3 – Has the skills to develop software modules that implement tasks related to ensuring the security of programs and data; skills to assess the level of protection of programs and data.

*Post requisites:* no.

*Optional component 3*

*Discipline:* **Programming Olympiad tasks**

*Intensity of the Course:* 4 academic credits

*Module code:* **SQSCSC - 9**

*Module name:* Selected Questions in the School Computer Science Course



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*Prerequisites:* Fundamentals of Scientific Research (in Informatics).

*Purpose:* to introduce students to the fundamental and most common algorithms that are used in Olympiad programming.

*Short description:* As part of the course, students study various algorithms, linear scanning method, dynamic programming, various algorithms on graphs, segment tree, etc. counts. As a result, students learn to solve problems that require the use of these algorithms in a complex for the direct solution of one of the above algorithms, as well as to solve complex problems.

*Learning Outcomes in EP (LOP):*

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems

LOP 4 – Applies subject and interdisciplinary knowledge to carry out scientific and practical research work.

LOP 7 – Creates algorithms and develops computer programs, interface design and mobile applications for solving applied problems, including those related to robotics programming in education.

LOP 8 – Applies the theory of computer science, applied knowledge of mathematics, computer and mathematical modeling programs in professional teaching activities.

*Learning Outcomes in Course (LOC):*

LOC 1 - knows methods of solving Olympiad problems of combinatorial nature, methods of solving graph problems;

LOC 2 - analyzes existing algorithms in terms of their effectiveness and applicability for solving applied problems;

LOC 3 - develops new algorithms for solving specific problems in the field of software engineering;

LOC 4 – assesses the complexity of the developed algorithms and substantiates their correctness.

*Post requisites:* no.

*Optional component 3*

**Course: Scientific Bases of School Course of computer science**

*Intensity of the Course:* 4 academic credits

*Module Code:* **SQSCSC - 9**

*Module Name:* Selected Questions in the School Computer Science Course

*Prerequisites:* Fundamentals of Scientific Research (in Computer science).

*Purpose:* to provide students with a solid and conscious mastery of the basics of knowledge about the processes of obtaining, converting, storing, transmitting and using information and on this basis to reveal the role of computer science in shaping the modern scientific picture of the world, the importance of information technology.

*Short Description:* The course will introduce students to the purpose and objectives of scientific works in the field of information technology, ways of organizing school scientific works, and methods of designing research works. The course is aimed at developing skills in the use of basic and auxiliary tools for the development of project work.

*Learning Outcomes in EP (LOP):*

LOP 3 - Demonstrate knowledge and compliance with ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote active, safe and ethical use of digital resources.

LOP 4 – Applies subject and interdisciplinary knowledge to carry out scientific and practical research work.

LOP 5 – Demonstrates knowledge and understanding of computer hardware and system software, computer architecture.

LOP 8 – Applies the theory of computer science, applied knowledge of mathematics, computer and mathematical modeling programs in professional pedagogical activity.

LOP 9 – Uses the content and methodological aspects of teaching computer science and evaluates the achievements of students in the development of critical thinking, is able to manage the educational process.

*Learning Outcomes in Course (LOC):*

LOC 1 – uses natural science and mathematical knowledge for orientation in the modern information space;

LOC 2 – knows the current state of the level and directions of development of information technology and software;

LOC 3 – analyzes the current state of the scientific foundations of school informatics;

LOC 4 – predicts the prospects for improving the scientific foundations of school informatics.

*Post requisites:* Industrial (pedagogical) practice.