KAZAKH NATIONAL WOMEN'S TEACHER TRAINING UNIVERSITY
HIGHER SCHOOL OF PHYSICS, MATHEMATICS AND DIGITAL TECHNOLOGIES
6B01514-Computer Science and Robotics
Catalog of elective disciplines

CONTENT

EDUCATIONAL PROGRAMME: 6B01514-COMPUTER SCIENCE AND ROBOTICS

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 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
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
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;
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 bissnes (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.

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.

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
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 programe)
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 5 - Applies physical and mathematical apparatus, computer science theory, computer modeling methods, and computational and experimental research methods in the course of professional activities.
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: **Programming Computer Games**
Intensity of the Course: 5 academic credits
Module Code: **TP-6**
Module Name: Programming Technologies
Prerequisites: Programming.

Purpose: mastering the types and methods of computer game programming with consideration of technologies and concepts sufficient for the professional development of computer games through familiarity with the modern educational complex, and analysis of the classification of computer games.

Short Description: The course covers the development of graphical computer games using Pygame in the Python programming language. In the course of studying the discipline, students will gain knowledge about the Pygame library and its functions. During the course, students master the skills of developing real computer games

Learning Outcomes in EP (LOP):

LOP 5 – Applies physical and mathematical apparatus, computer science theory, computer modeling methods, and computational and experimental research methods in the course of professional activities.

LOP 6 – Applies high-level programming languages to create computer applications and software prototypes to solve applied problems.

Learning Outcomes in Course (LOC):

LOC 1 – analyze the classification of computer games;

LOC 2 – knows the types and methods of programming computer games;

LOC 3 – knows how to use computer games.

Post requisites: Object Oriented Programming.

Optional component 1

Discipline: **Languages and Technologies of Programming**

Intensity of the Course: 5 academic credits

Module Code: **TP-6**

Module Name: Programming Technologies

Prerequisites: Methodology and Technology of Programming Training.

Purpose: teaching students the basic principles and methods of constructing programs in programming languages, necessary for the creation, research and operation of algorithms of various nature, to acquaint them with the semantics of programming languages and programming trends.

Short description: The course examines the basics of algorithmization, classification of programming languages, data types and classification of operators of algorithmic languages, program development using subroutines, standard modules, programming style, programming quality indicators, methods of debugging and testing programs.

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 5 – Applies physical and mathematical apparatus, computer science theory, computer modeling methods, and computational and experimental research methods in the course of professional activities.

LOP 6 – Applies high-level programming languages to create computer applications and software prototypes to solve applied problems.

Learning Outcomes in Course (LOC):

LOC 1 - uses the physical and mathematical apparatus to solve applied problems;

LOC 2 - conducts comparative analysis and makes an informed choice of algorithmic and software and hardware;

LOC 3 - has knowledge of technologies and methods of developing algorithms and programs;

LOC 4 - possesses the skills of working with a computer and programming in a high-level language.

Post requisites: Object Oriented Programming.

Optional component 2

Discipline: **Computer Architecture and Operating Systems**

Intensity of the Course: 6 academic credits

Module Code: **FT-5**

Module Name: Fundamental Training

Prerequisites: Informatics (school course)

Purpose: studying 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, mechanisms for transferring and managing information. And also to give a systematic idea of the principles of construction and operation 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 Outcome s in EP (LOP):

LOP 5 – Applies physical and mathematical apparatus, computer science theory, computer modeling methods, and computational and experimental research methods in the course of professional activities.

LOP 10 – Designs the information system in accordance with the task and provides data protection in computer systems and networks.

Learning Outcomes in Course (LOC):

LOC 1 - uses interdisciplinary knowledge to solve applied problems;

LOC 2 - classifies computers according to various characteristics, characteristics and characteristics of different classes of computers;

LOC 3 - knows the main architectures 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 operation of operating systems; architecture of modern operating systems.

Post requisites: no.

Optional component 2

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):

LOP 5 – Applies physical and mathematical apparatus, computer science theory, computer modeling methods, and computational and experimental research methods in the course of professional activities.

LOP 10 – Designs the information system in accordance with the task and provides data protection in computer systems and networks.

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 3

Course: **Physics**

Intensity of the Course: 5 academic credits

Module Code: **FT-5**

Module Name: Fundamental Training

Prerequisites: Physics (school course)

Purpose: formation and development of students' knowledge of the physical foundations of electrodynamics, thermodynamics and mechanics, necessary for the study and development of the field of robotics.

Short Description: This course covers the physical foundations of mechanics, thermodynamics, electrodynamics, physics of oscillations and waves, the basics of quantum physics. During studying the course, students develop the knowledge necessary for an engineer operating in the world of physical laws.

Learning Outcomes in EP (LOP):

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

LOP 5 – Applies physical and mathematical apparatus, computer science theory, computer modeling methods, and computational and experimental research methods in the course of professional activities.

Learning Outcomes in Course (LOC):

LOC 1 – has knowledge in the field of electrodynamics of physics;
LOC 2 - knows the basic laws and models of mechanics;
LOC 3 - uses the basic concepts and laws of thermodynamics in solving applied problems;
LOC 4 - conducts theoretical and practical research in physics;
LOC 5 - processes experimental data.
Post requisites: Circuitry, Integrated and microprocessor circuitry.

Optional component 3

Course: **Bases of Electronics**
Intensity of the Course: 5 academic credits
Module Code: **FT-5**
Module Name: Fundamental Training
Prerequisites: Physics (school course)
Purpose: formation of students ' knowledge on the basics of electronics, methods of designing and calculating electronic devices.
Short Description: The course is aimed at developing students' skills in diagnosing working capacity and using electronic devices; applying of methods for calculating transient and steady-state processes in linear and nonlinear electrical circuits; assembly and analysis of electrical circuits in robots.
Learning Outcomes in EP (LOP):
LOP 2 – Possesses high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems.
LOP 5 – Applies physical and mathematical apparatus, computer science theory, computer modeling methods, and computational and experimental research methods in the course of professional activities.
Learning Outcomes in Course (LOC):
LOC 1 – knows the principle of operation and design features of electronic devices;
LOC 2 - analyzes the physical phenomena occurring in electronic devices;
LOC 3 - analyzes the main characteristics of electronic devices;
LOC 4 - experimentally determines the parameters and characteristics of electronic devices and devices;
Post requisites: Circuitry, Integrated and microprocessor circuitry.

Optional component 4

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 study of problems related to the use of intelligent systems and the features of the use of intelligent measuring systems hardware, the use of methods with artificial intelligence concepts.
Short Description: The course provides for familiarization of students with the technical formulation of the main tasks solved by artificial intelligence systems; with concepts and methods that form the basis for understanding modern achievements of artificial intelligence. As a result of studying the course, students develop the skills of implementing intelligent systems using programming languages (Python, C++, etc.).
Learning Outcomes in EP (LOP):
LOP 5 – Applies physical and mathematical apparatus, computer science theory, computer modeling methods, and computational and experimental research methods in the course of professional activities.
LOP 9 - Creates algorithms to control virtual performers and artificial intelligence, and possesses technologies for construing and programming robot models in various development environments.
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.

Optional component 4

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 deals with the main directions of works in the field of artificial intelligence, the syntax of programming language for artificial intelligence, features of knowledge and models of their representation, methods of development and creation of expert systems. After passing the course students will be oriented 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 5 – Applies physical and mathematical apparatus, computer science theory, computer modeling methods, and computational and experimental research methods in the course of professional activities.

LOP 9 - Creates algorithms to control virtual performers and artificial intelligence, and possesses technologies for construing and programming robot models in various development environments.

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 5

Discipline: **Computer Networks**

Intensity of the Course: 6 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 course content discusses the functionality of communication equipment, the purpose of protocols and technology of data transmission in networks, computer setup and troubleshooting of computer network failures.

Learning Outcomes in EP (LOP):

LOP 5 – Uses physical and mathematical apparatus, Computer science theory, computer modeling methods, computational and experimental research methods in the process of professional activity.

LOP 7 - Applies network resources and software tools for developing networks and web applications in professional activities.

LOP 10 - Designs an information system according to the task at hand and provides data protection in computer systems and networks.

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 5

Discipline: **Cloud Technologies**
Intensity of the Course: 6 academic credits
Module code: **NTDP-7**
Module name: Network Technologies and Data Processing
Prerequisites: IKT 2109 Information and Communication Technologies (in English)
Purpose: The aim of the course is to form students with the necessary amount of theoretical and practical knowledge about cloud computing technology, skills and practical implementation of cloud technologies, and the study of the tools of this technology.
Short description: 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 problems of optimizing IT processes.
Learning Outcomes in EP (LOP):
LOP 5 – Uses physical and mathematical apparatus, Computer science theory, computer modeling methods, computational and experimental research methods in the process of professional activity.
LOP 7 - Applies network resources and software tools for developing networks and web applications in professional activities.
LOP 10 - Designs an information system according to the task at hand and provides data protection in computer systems and networks.
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;
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 6

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: Information and Communication Technologies.
Purpose: formation of 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 6 - Applies high-level programming languages to create computer applications and software prototypes to solve applied problems.
LOP 10 - Designs an information system according to the task at hand and provides data protection in computer systems and networks.
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: no.

Optional component 6

Discipline: **Databases and Information Systems**
Intensity of the Course: **5** academic credits
Module code: **NTDP-7**
Module name: Network Technologies and Data Processing
Prerequisites: Information and Communication Technologies (in English)
Purpose: the formation of students' professional competencies related to the use of knowledge in the field of theory and practice of databases, including knowledge of the principles and methods of developing information systems based on the concept of databases, as well as the SQL query language. The acquisition by students of the theoretical foundations and practical skills in the design and maintenance of databases using specific DBMS.
Short description: This course covers basic concepts, methods, and tools for building and using databases. Students will learn the history of development and the current state of the field, the typical organization of database management systems, the theoretical foundations of relational databases, learn how to create different data models, use the principles of information system design based on database technology, programming with the SQL query language.
Learning Outcomes in EP (LOP):
LOP 6 - Applies high-level programming languages to create computer applications and software prototypes to solve applied problems.
LOP 10 - Designs an information system according to the task at hand and provides data protection in computer systems and networks.
Learning Outcomes in Course (LOC):
LOC 1 - knows the role and place of databases in information systems;
LOC 2 - designs Relational Databases;
LOC 3 - applies data manipulation techniques using relational algebra tools for DBMS using the SQL language;
LOC 4 - provides the protection, integrity and safety of databases.
Post requisites: no.

Optional component 7

Discipline: **Computer Graphics**
Intensity of the Course: 6 academic credits
Module code: **SE-9**
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 studies methods and tools of computer graphics, features of vector, raster and three-dimensional graphics, algorithmic and mathematical foundations of computer graphics. It also considers techniques for creating and editing images in specialized software, additive, FDM, SLA, SLS technologies for printing images in 3D format.
Learning Outcomes in EP (LOP):
LOP 5 - Applies physical and mathematical apparatus, computer science theory, computer modeling methods, and computational and experimental research methods in the course of professional activities.
LOP 8 - Applies methods of processing and visualizing models of objects, processes and phenomena using specialized software.
LOP 9 - Creates algorithms to control virtual performers and artificial intelligence, and possesses technologies for construing and programming robot models in various development environments.
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 information6 including 3D models of objects.
Post requisites: no.

Optional component 7

Discipline: **Computer Modeling Basics**
Intensity of the Course: 6 academic credits
Module code: **SE-8**
Module name: STEM-Education

Prerequisites: Information and Communication Technologies.

Purpose: acquaintance of students with the elements of modeling and computer modeling, in particular, with the concept of a model and the classification of models, familiarity with the stages and basic techniques of modeling, the formation of formalization skills, building a model and its research.

Short description: The course is aimed at studying the principles of modeling, classification of ways to represent models, ways of formalizing objects, processes, phenomena and their implementation on the computer. During the course, students will learn to classify the initial problem to determine the ways of modeling systems, apply standard and non-standard software for modeling models and processes, and use specialized software packages simulation depending on the class of the problem of modeling.

Learning Outcomes in EP (LOP):

LOP 5 - Applies physical and mathematical apparatus, computer science theory, computer modeling methods, and computational and experimental research methods in the course of professional activities.

LOP 8 - Applies methods of processing and visualizing models of objects, processes and phenomena using specialized software.

LOP 9 - Creates algorithms to control virtual performers and artificial intelligence, and possesses technologies for construing and programming robot models in various development environments.

Learning Outcomes in Course (LOC):

LOC 1 - knows the principles of computer modeling, types of computer modeling, the main stages and Purposes of computer modeling, possible approaches to the classification of models;

LOC 2 - applies a systematic approach and mathematical methods to formalize the solution of applied problems;

LOC 3 - implements a computer experiment in solving problems where there is a need for computer mathematical modeling;

LOC 4 - applies methods of computer mathematical modeling in theoretical and experimental research.

Post requisites: no.

Optional component 8

Discipline: **Circuitry**

Intensity of the Course: 5 academic credits

Module code: **SE-8**

Module name: STEM-Education

Prerequisites: Physics, Bases of Electronics.

Purpose: the study of the principles of organization and design of digital computer circuits of various degrees of integration, as well as the acquisition by students of practical skills in their research, operation and optimization.

Short description: This course explores digital integrated circuitry and its practical applications in robotics. As a result of studying the course, students develop knowledge about the development of integrated digital circuitry, about the architecture and programming of typical microprocessor systems, about methods of automated modeling and design of electronic circuits.

Learning Outcomes in EP (LOP):

LOP 5 – Applies physical and mathematical apparatus, computer science theory, computer modeling methods, and computational and experimental research methods in the course of professional activities.

LOP 9 – Creates algorithms to control virtual performers and artificial intelligence, and possesses technologies for construing and programming robot models in various development environments.

Learning Outcomes in Course (LOC):

LOC 1 - has knowledge of the element base of circuit engineering;

LOC 2 - determines the parameters of semiconductor devices and elements of system technology;

LOC 3 - constructs logic circuits;

LOC 4 - logically designs on the basis of microcircuits.

Post requisites: Robotics in education.

Optional component 8

Discipline: **Integrated and microprocessor circuitry**

Intensity of the Course: 5 academic credits

Module code: **SE-8**

Module name: STEM-Education

Prerequisites: Physics, Bases of Electronics.

Purpose: to give an idea of the principles of operation of integrated and microprocessor technology and the design of complex electronic devices.

Short description: The discipline is aimed at familiarizing students with the basics of digital integrated circuits and their practical application in robotics, getting an idea about the development of integrated digital circuits, architecture and programming of typical microprocessor systems, methods of automated modeling and design of electronic circuits.

Learning Outcomes in EP (LOP):

LOP 5 – Applies physical and mathematical apparatus, computer science theory, computer modeling methods, and computational and experimental research methods in the course of professional activities.

LOP 9 – Creates algorithms to control virtual performers and artificial intelligence, and possesses technologies for construing and programming robot models in various development environments.

Learning Outcomes in Course (LOC):

LOC 1 - knows the basic concepts of the principles of operation of integrated and microprocessor technology, the structure and manufacturing technology of integrated circuits;

LOC 2 - applies knowledge in determining the basic characteristics and parameters of electronic devices and microcircuits, build the simplest electronic circuits on electronic devices and microcircuits;

LOC 3 - is able to use methods and technologies of the design processes of integrated electronic components.

Post requisites: Robotics in education.

Optional component 9

Discipline: **Methods of Programming Robots**
Intensity of the Course: 6 academic credits
Module code: **TP-6**
Module name: Programming Technologies
Prerequisites: Object Oriented Programming.
Purpose: familiarization of students with the basic concepts, tools and programming languages for the development of applied software solutions for robot control.
Short description: During the course, students form knowledge of the general principles of robot programming. Such topics as robot application software development environment (LEGO Mindstorms EV3, ROBOTC, NXT, etc.), robot programming languages (Java, C++, Python, etc.), and robot control methods are covered.
Learning Outcomes in EP (LOP):
LOP 5 – Applies physical and mathematical apparatus, computer science theory, computer modeling methods, and computational and experimental research methods in the course of professional activities.
LOP 6 - Applies high-level programming languages to create computer applications and software prototypes to solve applied problems.
LOP 9 – Creates algorithms to control virtual performers and artificial intelligence, and possesses technologies for construing and programming robot models in various development environments.
Learning Outcomes in Course (LOC):
LOC 1 - knows the methods and instrumental programming environments of robot dynamics;
LOC 2 - applies analytical and numerical methods and algorithms for solving robotics problems using programming languages;
LOC 3 - applies robot programming methods to solve problems of a theoretical and applied nature.
Post requisites: no.

Optional component 9

Discipline: **Arduino Programming**
Intensity of the Course: 6 academic credits
Module code: **TP-6**
Module name: Programming Technologies
Prerequisites: Object Oriented Programming.
Purpose: formation and development of students' system of technological knowledge and skills necessary for the creation of robotic systems.
Short description: During the course, students will learn how to work with Arduino from a technical and a software part. In addition, they will learn how to create devices and robots, program their required actions. And they will also master the methodology of teaching Arduino technology to future students.
Learning Outcomes in EP (LOP):
LOP 5 – Applies physical and mathematical apparatus, computer science theory, computer modeling methods, and computational and experimental research methods in the course of professional activities.

LOP 6 - Applies high-level programming languages to create computer applications and software prototypes to solve applied problems.

LOP 9 – Creates algorithms to control virtual performers and artificial intelligence, and possesses technologies for construing and programming robot models in various development environments.

Learning Outcomes in Course (LOC):

LOC 1 - uses electronic components: control boards, expansion boards, electric motors, sensor devices, ultrasonic and infrared ranges.

LOC 2 - programs in the programming languages C ++, Python;

LOC 3 - uses basic algorithmic constructions to control technical devices;

LOC 4 - compiles algorithms and programs for controlling the robot.

Post requisites: no.

3. OPTIONAL COMPONENTS OF THE CYCLE OF MAJOR DISCIPLINES

Optional component 1

Discipline: **Information Security**
Intensity of the Course: 6 academic credits
Module code: **NTDP-7**
Module name: Network Technologies and Data Processing
Prerequisites: Information and Communication Technologies.
Purpose: the formation of future specialists' knowledge about the basic concepts and methods of protecting information (data, knowledge) and software (system, applied, instrumental).
Short description: This course covers the basic concepts of IS, and the structure of IS measures, and briefly describes legislative, administrative, procedural, and software and hardware measures. The course provides students with an understanding of information security, its components, major threats, protocols, and protection tools. The course provides students with basic information security skills and introduces them to professional tools and programs.
Learning Outcomes in EP (LOP):
LOP 5 – Applies physical and mathematical apparatus, computer science theory, computer modeling methods, and computational and experimental research methods in the course of professional activities.
LOP 10 - Designs the information system in accordance with the task and provides data protection (BigData) in computer systems and networks.
Learning Outcomes in Course (LOC):
LOC 1 - uses a physical and mathematical apparatus to solve applied problems;
LOC 2 - knows the basic functions, the purpose of the components and the principles of building computer security systems;
LOC 3 - has knowledge of the problems of building information security systems (SIS) and organizing its functioning, as well as the main directions of solving these problems and directions for further development;
LOC 4 - uses elements of information security in solving practical problems.
Post requisites: no.

Optional component 1

Discipline: **Software and Data Security**
Intensity of the Course: 6 academic credits
Module Code: **NTDP-7**
Module Name: Network Technologies and Information Systems
Prerequisites: Information and Communication Technologies.
Purpose: development of projects of systems and subsystems for protection of programs and data in accordance with the terms of reference.
Short description: The course examines the main encryption methods, cryptographic protocols with examples of their use in solving practical problems, basic algorithms used in cryptosystems, and also includes measures taken to improve the security of programs and data, often by detecting, correcting, and preventing security vulnerabilities. To identify vulnerabilities at different stages of the program's life cycle.
Learning Outcomes in EP (LOP):
LOP 5 – Applies physical and mathematical apparatus, computer science theory, computer modeling methods, and computational and experimental research methods in the course of professional activities.
LOP 10 - Designs the information system in accordance with the task and provides data protection (BigData) in computer systems and networks.
Learning Outcomes in Course (LOC):
LOC 1 - uses a physical and mathematical apparatus for solving applied problems;
LOC 2 - knows the requirements for the audit subsystem and audit policy; protective mechanisms and means to ensure the security of programs and data;
LOC 3 - implements measures to counter security breaches using various software and hardware protection tools;
LOC 4 - 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 2

Discipline: **Web technologies**
Intensity of the Course: 6 academic credits
Module code: **NTDP-7**
Module name: Network Technologies and Data Processing.
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: The purpose of the course is to study 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 practical activities. The course introduces students to the basics of web application development. The main development language will be JavaScript, PHP, HTML and CSS.
Learning Outcomes in EP (LOP):
LOP 5 – Applies physical and mathematical apparatus, computer science theory, computer modeling methods, and computational and experimental research methods in the course of professional activities.
LOP 6 - Applies high-level programming languages to create computer applications and software prototypes to solve applied problems.
LOP 7 - Uses networking resources and tools to develop networks and web-based applications in professional activities.
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 2

Discipline: **IoT Technologies**
Intensity of the Course: 6 academic credits
Module code: **NTDP-7**
Module name: Network Technologies and Data Processing.
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):
LOP 5 – Applies physical and mathematical apparatus, computer science theory, computer modeling methods, and computational and experimental research methods in the course of professional activities.
LOP 6 - Applies high-level programming languages to create computer applications and software prototypes to solve applied problems.
LOP 7 - Uses networking resources and tools to develop networks and web-based applications in professional activities.
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)
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 3

Discipline: **Programming Olympiad tasks**

Intensity of the Course: 6 academic credits
Module code: **SQSCSC - 9**
Module name: Selected Questions in the School Computer Science Course
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: The aim of the course is to introduce students to the fundamental and most common algorithms used in olympic programming. As part of the course students will look at various algorithms, the scanning line method, dynamic programming, various algorithms on graphs, the segment tree, etc. As a result, students will learn to solve problems for which it is necessary to use one of the above-mentioned algorithms, as well as to apply these algorithms together to solve more 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
LO3 P - 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, and promote the active, safe, and ethical use of digital resources.
LOP 4 - Distinguishes types of assessment, uses content and methodological aspects of teaching computer science and robotics that promote critical thinking, and is able to manage the teaching and learning process.
LOP 5 - Applies physical and mathematical apparatus, computer science theory, computer modeling methods, and computational and experimental research methods in the course of professional activities.
LOP 6 - Applies high-level programming languages to create computer applications and software prototypes to solve applied problems.
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

Discipline: **Scientific bases of a School Course of Computer Science**
Intensity of the Course: 6 academic credits
Module code: **SQSCSC - 9**
Module name Selected Questions in the School Computer Science Course
Prerequisites: Fundamentals of Scientific Research (in Informatics).
Purpose: to ensure a solid and conscious mastery by students of the basics of knowledge about the processes of obtaining, transforming, storing, transferring and using information and, on this basis, to reveal the role of informatics in the formation of a modern scientific picture of the world, the value of information technologies.
Short description: The course will introduce students to the purpose and objectives of research papers in information technology, ways to organize school research papers and methods of designing research papers. The course is aimed at the formation of skills in the application of basic and auxiliary tools for the development of design works.
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
LO3 P - 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, and promote the active, safe, and ethical use of digital resources.
LOP 4 - Distinguishes types of assessment, uses content and methodological aspects of teaching computer science and robotics that promote critical thinking, and is able to manage the teaching and learning process.
LOP 5 - Applies physical and mathematical apparatus, computer science theory, computer modeling methods, and computational and experimental research methods in the course of professional activities.
LOP 6 - Applies high-level programming languages to create computer applications and software prototypes to solve applied problems.
Learning Outcomes in Course (LOC):
LOC 1 - uses natural science and mathematical knowledge to navigate 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 computer science;

LOC 4 - predicts the prospects for improving the scientific foundations of school computer science;
Post requisites: no.