Kazakh Humanitarian Juridical Innovative University

Faculty of Information Technology and Economics

Department of "Information – technologies science»

6B06124 «Computer facilities and the software»

CATALOGUE OF ELECTIVE COURSES

Full-time education – 2 years (DOT)

year of admission – 2020

Semey, year 2020

Academic degree bachelor of engineering and technology in the educational program 6B06124 «Computational technology and software»
Course of education: 5B057 – Information technologies

№	Discipline	Amount of credits		Prerequisites	Postrequisites	Prerequisites Postrekvizity Brief description indicating the purpose of the study, executive summary, and expected results of the study (knowledge, skills, competences)
		PK	ECTS			
BASIC DISCIPLINES						
Be sure to select (BSS)						
1	Introduction in specialty	6		Scool of Informatics Course	Operating systems Programming languages and technologies	**Aim:** Learning the knowledge and skills of using modern software **Content:** Introduction. Basic concepts and information about the specialty. Information computer systems. Educational and scientific complex of higher educational institutions. Higher education in Kazakhstan. The main documents on the organization and conduct of classes, their content. **Expected result:** **Know:** the volume and level of requirements for bachelors in "Computer science and software", the content of the curriculum for the period of study; physical basis of PC operation, its main technical characteristics and functionality; professional problems in the field of computing and telecommunications; general description of specialty, field, objects, types of professional activity, tasks of design, research, organizational, managerial and operational activities; features a variety of operating systems and architecture. **Able to:** to put, formulate problems of technical projects for the implementation of programming tasks and technical solutions in the professional field; identify technical and logical problems in the analysis of specific situations for programming, suggest ways to solve them and evaluate the expected results; to systematize and generalize information, to prepare references and reviews in professional activities, edited, abstracted, reviewed texts; use basic and special methods of information analysis in the field of professional activity; to develop and prove variants of effective decisions; critically evaluate from different sides (production, motivational, institutional, etc.) the development trends of objects in the field of professional activity; knowledge gained in the study of mathematics, physics; plan and conduct research, analyze and interpret the data obtained;

					analyze, program, design and operate software and hardware systems and security systems; use modern technical means necessary in engineering practice. **Possess skills:** special technical, economic terminology and vocabulary, self-mastery of new knowledge, using modern educational technologies; work with technical documentation and literature to solve problems of computer engineering and telecommunications; - methods of mathematical, simulation and computer simulation of processes and devices of computer technology.
1	Basics of work on a personal computer	6	Scool of Informatics Course	Operating systems, environments and shells Programming languages	**Aim:** Familiarize students with the system and methods of studying a personal computer, the programs with which they will work, the trends of development, as well as the development of their own potential in modern conditions. **Content:** Hardware. Introduction to Windows. Create a basic text document. The toolbar editor “WORDPAD”. The main functions of the editor “WORDPAD". Additional functions of the editor “WORDPAD”. **Expected result:** **Know:** the volume and level of requirements imposed to bachelors in the specialty "Computer facilities and software»; the general characteristic of specialty, area, objects, types of professional activity, tasks of design, research, organizational and administrative and operational activity; features of different operating systems, architecture. **Able to:** to identify problems of a technical and logical nature in the analysis of specific situations for programming, to suggest ways to solve them and to evaluate the expected results; to systematize and summarize information, to prepare references and reviews on professional activities, to edit, to refer, to review the texts; use basic and special methods of information analysis in the field of professional activity; to develop and prove variants of effective decisions; critically evaluate from different sides (production, motivational, institutional, etc.) trends in the development of objects in the field of professional activity; apply the knowledge gained in the study of mathematics, physics; plan and conduct research, analyze and interpret the data obtained; analyze, program, design and operate software and hardware systems and security systems; to use modern technical tools necessary in engineering practice. **Possess skills:** special technical, economic terminology and vocabulary of the specialty

2	Information theory	5	Probabilities theory and Math statistics	Information security and information safety	**Aim:** Introduction to the basic concepts of information theory, the study of models of information processes and their organization at the physical and channel level. **Content:** Basic concepts and problems of information theory. The measurement information. Data transfer rate and bandwidth of communication channels. Mathematical models of signals. Channels and communication systems. Information coding. Quantization of information. **Expected result.** **Know:** on the concept of information, methods of transmission of digital information, information processing, preservation and their technical characteristics and functionality, the basis of the theory of data compression. **Able to:** use basic models and means of information transmission to optimize modern computer systems. **ssess skills:** presentation of information; methods and means of determining the amount of information; encoding and decoding information.
2	Information technologies	5	Discrete Math	Information security	**Aim:** Introduction to the basic concepts of information and information technologies, classification of information technologies by fields of application. **Content:** The Information. Information technology. Information technologies in the fields of application. Information security. The main types of threats to information security. Means of information protection. Identification and authorization of network users and resources **Expected result:** **Know:** basic concepts: information and information technology; technologies for collecting, storing, transmitting, processing and providing information; classification of information technologies by fields of application: processing of text and numerical information, hypertext methods of storage and presentation of information, document markup languages; general information about computers and computer networks: the concept of information system, data, databases, personal computer, server; assign the computer a logical and physical structure of computer, hardware and software; processor, RAM, disk and video subsystems; peripherals: interfaces, cables and connectors; personal computer (PC) operating system, file systems, file formats, file management programs; local networks: protocols and standards of local networks; topology of networks, structured

					cabling systems, network adapters, hubs, switches, logical network structuring; identification and authorization of users and network resources; General information on global computer networks(Internet), addressing, domain names, data protocols, hypertext presentation, WorldWideWeb network (WWW), e-mail, server and client software; information security: main types of threats, ways to counteract threats **Able to:** work with graphical operating systems of a personal computer (PC): enable, disable, manage sessions and tasks performed by the operating system of a personal computer; work with file systems, different file formats, file management programs; work in applications: text and table editors, presentation editor, use information from technical documentation and help files. **Possess skills:** presentation of information; search for files, computers, and network resources; methods and means of determining the amount of information.
3	Probabilities theory and Math statistics	3	Scool of Mathematics Course	Information theory	**Aim**: to obtain generalized knowledge of any probabilistic and statistical systems, to identify common patterns of their construction and operation. Identification of objects of application of the acquired knowledge with the use of modern information technologies. **Contents**: the Subject of probability theory and mathematical statistics. Basic concepts of probability theory. Trials and events. Actions on events. Random event. Types of random events. Basic formulas of combinatorics. The classical definition of probability. The theorem of adding the probabilities of incompatible events. Full group of events. Opposite events. Independent and dependent events. Multiplication theorem for independent events. Conditional probability. The solution of problems on conditional probability. **Expected result:** **Know:** - regularities in random and information processes (type of distribution, numerical characteristics, accumulation, processing, distribution, etc.)) **Able to:** - create mathematical and computer models of random phenomena in various fields of human activity; **Own skills:** - information about the main scientific achievements in the theory of probability and mathematical statistics;

3	Discrete mathematics	3	Scool of Mathematics Course	Information technologies	**Aim:** Acquaint students with the most important sections of discrete mathematics and its application in computer science. **Content:** Set, element of set, subset. Operation on sets and their properties. Binary relations and their properties. The equivalence relation and split into classes. Types of functions: injections, surjections and bijections, inverse and compositions. Dirichlet principle. Construction of the truth table of logical formulas. Methods of proof: direct, inverse, negative, mathematical induction. Combinatorics. **Expected result:** **Know:** basic concepts of sets; algebraic methods model description; elementary functions of logic algebra, properties and their analytical representation; foundations of the logical calculus of propositional and predicate; methods for solving classical problems formulated in terms of combinatorics**.** **Able to:** to apply combinatorial configuration for solving problems to determine the type of binary relations and its properties, perform operations on sets to represent graphs in different ways, to perform operations on graphs, finding shortest path graph, construct the truth table Boolean function, perform the identity transformation, find SDNF, SCNF to determine the minimum DNF. **Possess skills:** use of basic tools of discrete mathematics for solving applied problems; method of construction, analysis and application of discrete models in professional activity.
4	Operating systems	5	Introduction to specialty	Object-oriented programming C++	**Aim:** Training in knowledge and skills of using modern software, obtaining knowledge about modern operating systems, their functional architecture, the resources and methods implemented by them, management of resources of computer complexes. To teach knowledge and skills in the use of modern software, to familiarize with the effective algorithms for solving various scientific and technical problems. **Content:** General information about operating systems. History of operating systems. The architecture of the operating system. The basic functions of the OS. Processes and flows. Memory management. File system. Input and output management. The management of real memory. Configure network settings and share resources on local networks. Programming with system calls on the Windows operating system in the Linux System shell **Expected result:** **Know:** the concept, principles, types and functions of operating systems; operating environment; machine-independent properties of operating systems.

					Able to: install and maintain operating systems; take into account the peculiarities of work in a particular operating system, organize support for applications of other operating systems; use the tools of the operating system. **Possess skills:** security and fault tolerance of operating systems; principles of construction of operating systems; ways of organizing device support, hardware drivers, network operating systems.
4	Operating systems, environments and shells	5	Basics of work on a personal computer	Functional programming	**Aim:** Study the theoretical principles and algorithms underlying the development of modern operating systems and shells, the development of problems in this area, a review of research areas, obtaining skills of installation, configuration and administration of operating systems Win32 and UNIX families. **Content:** Introduction. History of operating systems and shells. The basic functions of the OS. Processes and flows. Memory management. File system. Input / output control. **Expected result:** **Know:** current state of the level and directions of development of computer technology and software; main stages, methods, means and standards of software development; main types of operating systems, operating system resource management principles; features of operation in specific operating environments and shells; service software tools; methods of organizing, storing and processing information on the computer (technology of processing information on the computer). **Able to:** to work in a chosen environment; to learn a new operating system or shell program; to obtain information about users, processes, directories, reference on system commands; to perform a message exchange with other users; create and view directories, copy, move and delete files, manage file access mode; to create, view and merge text files, search pattern, search file according to the specified parameters, to use pipelines and redirection input / output. **Possess skills:** security and fault tolerance of operating systems; principles of construction of operating systems and shells; ways of organizing device support, hardware drivers, network operating systems.

5	Programming languages and technologies	5	Introduction to specialty	Object-oriented programming in C++ Programming on 1C	**Aim:** Teach students the basic principles and methods of building programs in programming languages, to familiarize with the semantics of programming languages, formal languages specifications, object-oriented specifications. **Content:** Structural, modular, object - oriented programming. Basic concepts and mechanisms of the environment of input and execution of programs. Base data type. Basic principles of organization and structuring of programs. Key concepts and linguistic means to describe software objects. Operating personnel. The main means of data processing. Preprocessor tools. Algorithmic basis for writing effective programs. Basic principles and means of organization of the software interface. Functions. Basic principles of program development. **Expected result:** **Know:** programming methods and technologies; basic data processing algorithms; about modern programming languages; about the structure of computing systems; **Able to:** develop algorithms; to implement algorithms in the programming language high-level; implement the methods of analyzing and processing data; work in programming environments. **Possess skills:** methods and technology development of algorithms; high-level programming language; work in various programming environments.
5	Programming languages	5	Basics of work on a personal computer	Functional programming Database design	**Aim:** Consider the basics of building languages and programming methods, the study of the basic types and structures of data and algorithms for their processing, teaching students the basics of programming based on C++programming language. **Content:** Basic concepts of programming languages. Lexical analysis. Semantic analysis of program code. Object-oriented programming (OOP). Programming in language C **Expected result:** **Know:** terminology of discipline; basic structures and tools that are used in programming languages such as C++: main structures and types of C++ data; main methods in the development of algorithms (recursion, backward, branch and boundary methods, analysis of arithmetic expressions); basic algorithms; dialects C++, including used in programming microcontrollers; library of standard programs. **Able to:** to apply programming techniques in the development of information systems; determine data structures in the design of algorithms in the process of solving problems;

					break down the solution of a complex problem into a sequence of more simple tasks. **Possess skills:** use the library of standard programs that are included in the programming language C++; self-settling in the programming language that you must use when solving problems.
6	Object-oriented programming in C++	5	Programming languages and technologies	Programming on PHP	**Aim:** In-depth study and development of programming languages based on object-oriented and generalized (using a standard library) programming technology, as the base language is used high-level programming C++. **Content:** Classes. Encapsulation. The design of conventional classes. Reference type. The creation and destruction of objects. Constructors and Destructors. Copy constructor. Hopscotch. Inheritance. The Programming Methods. Override operators (operations). Sorting of arrays. Virtual methods of classes, destructors. Abstract methods and classes. The use of virtual functions. Hopscotch. Encapsulation. Class member. Constructors and destructors. Friends classes. Overloading of operations. Templates. Name space. Expected result: **Know:** the concept of object-oriented programming, its basic concepts (class, object), properties (encapsulation, inheritance, polymorphism); method of analysis and design of object-oriented programs; the basic concepts, the syntax and semantics of the constructs of the programming language C++; methods of drawing up object-oriented programs in C++programming language; features of the integrated programming environment in C++. **Able to:** debug and test programs written in C++; formulate the problem statement; perform a formalized description of the task, its algorithmization; based on the existing algorithm to build a computer program in algorithmic languages and C++. **Possess skills:** object-oriented design; development of object-oriented software code in modern operating systems.
6	Functional programming	5	Programming languages	Web programming	**Aim:** Formation of students ' General methodological foundations and practical skills of developing software systems using a functional approach to programming **Content**: Introduction to functional programming. Introduction to the course. The paradigm of functional programming. A comparison of imperative and functional programming. The characteristic features of functional programming. Fundamentals of lambda calculus. Reasons for the use of lambda calculus formalization. The concept of lambda expression. Currying. Free and connected

					variables, expressions. **Expected result:** **Know:** - features of artificial intelligence problems and the role of functional programming as methodologies for solving these problems; - trends and prospects of functional programming tools development; - fundamentals of lambda calculus theory and practice. **Able to:** - develop software applications for solving the tasks in the functional programming language; - develop algorithms for solving problems for functional programming **Possess skills:** - work with the software application for solving of the tasks in a functional programming language; - development of algorithms for solving problems for functional programming.
7	Setting up, repair, optimization and maintenance of computer systems	4	Microcontrollers and microprocessor systems	Software development technology	**Aim:** Development of professional competences of students necessary for realization of professional activity, formation of abilities and skills on performance of the works connected with maintenance and repair of computer systems and complexes. **Content:** Configuring the computer equipment. Test the hardware with the debugger. Testing of hardware with the help of diagnostic programs. Create bootable media. Determining the parameters of the power supply. Testing the video system. Testing the CPU. Testing the hard drive. Restore the operating system to a healthy state. Keyboard and mouse maintenance. Test ports on the motherboard. Maintenance of the local network. **Expected result:** **Know:** - features monitoring and diagnostic devices hardware and software systems; - main diagnostic methods; - hardware and software functional control and diagnosis of computer systems capabilities and applications of standard and special test equipment to locate the ground fault SWT; - use of service tools and built-in test programs; - hardware and software configuration of computer systems and complexes; - installation, configuration and configuration of the operating system, - drivers, resident programs; methods of ensuring stable operation of computer systems and complexes. **Able to:** - to control, diagnose and restore the performance of computer systems and systems; - to carry out system technical maintenance of computer systems and complexes; - take part in debugging and technical testing of computer systems and systems; - installation, configuration and configuration of the operating system, drivers, resident

					programs. **Possess skills:** - carrying out of control, diagnostics and restoration of working capacity of computer systems and complexes; - systems engineering computer systems and complexes; - debugging of hardware-software systems and complexes; - installation, configuration and configuration of the operating system, drivers, resident programs.
7	Maintenance and repair of computer systems and complexes	5	Fundamentals of microprocessor technics	Software development process	**Aim**: the study of the discipline is the development of professional competencies of students necessary for the implementation of professional activities, the formation of skills and abilities to perform work related to the maintenance and repair of computer systems and complexes. **Contents**: Control and diagnostics of computer systems and complexes. Structure of computer systems and complexes Generalized structure of computer systems and complexes. Hardware of functional control and diagnostics of computer systems and complexes, their application. Software for functional control and diagnostics of computer systems and complexes, their application. **Expected result:** **Know**: - to control, diagnose and restore the performance of computer systems complexes; - carry out system maintenance of computer systems and complexes; - take part in debugging and technical testing of computer systems and complexes, installation, configuration and configuration of the operating system, drivers, resident programs; - comply with safety regulations; **Able to:** - features of control and diagnostics of devices of hardware and software systems; main diagnostic methods; - hardware and software for functional control and diagnostics of computer systems and complexes, possibilities and applications of standard and special control and measuring equipment for localization of fault locations of SVT; - application of service tools and built-in test programs; - hardware and software configuration of computer systems and complexes; - installation, configuration and configuration of the operating system, drivers, resident programs, methods of ensuring the stable operation of computer systems and complexes; - rules and norms of labor protection, safety, industrial sanitation and fire protection. **Own skills:** - monitoring, diagnostics and recovery of computer systems and complexes;

8	1C programming	2	Programming languages and technologies	Modern methods and means of Java programing Software in business	**Purpose**: to Teach future specialists a complex of special knowledge and skills in the field of design and organization of highly efficient automated production processes of mechanical Assembly production in mechanical engineering. **Contents**: Introduction. Aspects and fundamental theories of automation of production processes in mechanical engineering. Social and technical and economic aspects of automation. The main stages of automation of production processes Theory of labor productivity. Sources of progressiveness of automatic systems reliability Theory of automatic equipment **Expected result:** **Know**: - principles of construction of automatic machine systems and fundamental theories of automation of production processes; - features of automation of Assembly processes; - target mechanisms of automatic machines and automatic lines; **Be able to:** - design separate target mechanisms of automatic machines and automatic lines; - to design an automatic machine tool systems; - perform calculations of the performance and reliability of automatic equipment; **Possess skills:** - analysis of the performance, reliability and cost-effectiveness of automatic lines; - processing and analysis of statistical information on the reliability, performance and efficiency of automatic systems operation
8	Database design	2	Programming languages	Modern methods and means of NET programing Fundamentals of Internet Business	**Aim:** Formation of students ' deep theoretical knowledge in the field of management, data storage and processing, as well as practical skills. **Content:**Introduction to the database. Database technology, basic concepts and definitions. DBMS, architecture of DBMS. Hierarchical, network, and relational data models. Relational systems, classification, client. Stages of database design. **Expected result:** **Know:** features of the relational model and their impact on database design, visual AIDS used in ER modeling; basics of relational algebra; principles of database design, ensuring the consistency and integrity of data; design database structures; SQL query language. **Able to:** design a relational database; use SQL to programmatically retrieve information from databases. **Possess skills:** searching and structuring information; modern techniques and technologies for the development and support of technical systems.

9	Computer-modeling	5	Information theory	The use of data in machine learning	**Aim:** Development by students of methodology and technology of modeling (first of all computer) at research, design and operation of information systems. **Content:** Basic concepts of system modeling. Tools for modeling systems. Operation of the system. Formalization and algorithmization of processes of functioning of systems. Methods of planning experiments. Modeling of systems using typical machine schemes**.** **Expected result:** **Know:** main concepts of modeling theory, classification of models and their use, modeling problems; main modeling tools used in the process of designing systems at different stages of project detail; methods of modeling and analysis of systems; principles of construction of models. **Able to:** perform an analysis of the system or process under study; reasonably choose a modeling method; to build an adequate model of the system or process using modern computer tools; to interpret and analyze the simulation results. **Possess skills:** the main criterion of evaluation of the obtained simulation results; experience of work and use in simulation of scientific and technical information.
9	Mathematical and computer modeling	5	Information technologies	Introduction to machine learning and data analysis	**Aim:** Study the methodology and technology of mathematical and computer simulation in the study, design and operation of computer technology. **Content:** the Concept of models and modeling. Basic methods of simulation. Classification of models. Formulation of the linear programming problem and methods of its solution. Basic concepts of game theory. The formulation of game problems. The models and methods of solving game theory problems. **Expected result:** **Know:** methods for solving basic mathematical problems-integration, - differentiation, solving linear and transcendental equations and systems of equations using computers; basic principles of mathematical models; the main types of mathematical models. **Able to:** use basic numerical methods for solving mathematical problems; to develop algorithms and programs for solving computational problems, taking into account the necessary accuracy of the result; to select analytical methods for studying mathematical models; to use numerical methods for studying mathematical models. **Possess skills:** the solution of computational problems using computer modeling.

10	Modern methods and Java software	5	Programming on 1C	Preparing theses	**Aim:** Development Of methods and tools, as well as the basics of programming for Windows on Java and prepare for their active use in solving problems selected specialties. **Content:** The data structure and operations that apply to them. The control statements. Data entry and output. Arrays. Edit the arrays. Work with files. String manipulation. Treatment of special cases. Object-oriented programming in Java. Properties of the target programming. Packages and interfaces. Graphic primitive. Java integrated environment. Simple Java applications. **Expected result:** **Know:** types, the characteristics of the data operations, and language operators; principles of object-oriented programming; fundamentals of computer networks and associations of networks, the internet, concepts, programming environment Java. **Able to:** use classes to process applications; work with files; use the principles of building a graphical interface, graphical primitive; convert applets. **Possess skills:** work with operators, with arrays of application processing; create classes, methods, publications, objects; creating client components and applications; work with Java network technologies.
10	Modern methods and software NET	5	Database design	Preparing theses	**Aim:** Mastering methods and tools, as well as the basics of programming for Windows on NET and preparing for their active use in solving the problems of the selected specialties. **Content:** Basics of computer networks and networking. Internet services. The concept of the world wide web (world wide web). **Expected result:** **Know:** types, the characteristics of the data operations, and language operators; principles of object-oriented programming; basic principles of computer networks and networking, internet services, concepts, programming environment NET. **Able to:** use classes to process applications; work with files; use the principles of building a graphical interface, graphical primitives; convert applets. **Possess skills:** work with operators, with arrays of application processing; create classes, methods, publications, objects; creating client components and applications; work with NET network technologies.

11	The use of data in machine learning	3	Artificial intelligence systems Computer modeling	Preparing theses	**Purpose:** this academic discipline is implemented as a series of lectures and practical classes that introduce students to the theoretical foundations and algorithms of machine learning, their practical implementation and use in solving specific problems. In this course, students should have an understanding of the principles of constructing some of the main classifiers and the problems to be solved using the theory in question. **Contents**: Introduction to machine learning. Statistical evaluation and hypothesis testing. Machine learning as mathematical modeling. Introduction to linear models and the problem of regression. Linear models and classification problems **Expected result:** **Know**: - principles for constructing feature vectors, decision rules, and classification; - main types of classifiers; - principles of construction of linear classifiers; - principles of constructing nonlinear classifiers; - selection of classification features and features of pre - processing of data. **Able to:** - selecting the appropriate type of classifier depending on the problem being solved; - selecting a set of features for classification and pre-processing data; - ability to use algorithms for training and compiling a classifier for selection; - Performing calculations related to the study and operation of the classifier in the MATLAB environment **Skills**: - skills for selecting, creating, training, and using basic classifiers problem solving
11	Introduction to machine learning and data analysis	3	Artificial intelligence systems	Fundamentals of robotics and artificial intelligenceof Internet Business	**Aim**: to master the skills of working in Python, knowledge and understanding of data management tasks, including data loading, data conversion, and preliminary data analysis and visualization, familiarization with the main tasks and models of machine learning, knowledge of methods for evaluating the quality of various machine learning models, understanding the process of combining machine learning models within the tasks facing potential customers. increasing students ' interest in further deepening their knowledge in the field of data processing and machine learning **Contents**: discrete analysis and probability theory. Introduction to machine learning. Neural network. Criteria for selecting models and methods for selecting features. Logical classification methods. Clusterization methods **Expected result:** **Know**: - the main methods of data transformation; - know the main tasks of machine learning; the

					main models of machine learning; - Main stages of the machine learning project **Able to:** - these works massivement; - Formalizing a business task as a machine learning task - solving machine learning tasks in specific business tasks **Skills**: - Loading, converting, clearing, and visualizing data in Python - Applying machine learning models in Python - quality assessment and interpretation of the results obtained
12	Fundamentals of robotics and artificial intelligence	5	Scool of Mathematics Course	Artificial intelligence systems	**Aim** of the course: to familiarize students with the basics of robotics, training programs for mobile robots **Contents**: Fundamentals of robotics. Physical fundamentals of robotics.Information in modulating, information processes.Design basics.Mobile work. From simple to complex.Algorithmization. Programming mobile robots.The decision of applied problems. Education robotics. **Expected result:** **Know**: mathematical models of systems of automation and robotization of production processes using modern software data; analyze and evaluate mathematical models of systems of robotization and automation of production processes using modern software data. **Be able to**: design automation and robotization systems; comparative analysis with the use of modern software products for the robotization of technological complexes and systems for automating production processes in various industries, as well as artificial intelligence methods.; **Possess the skills** to form modern trends in the development of robotic systems and automation of production processes
12	Robotic systems and complexes	5	Scool of Mathematics Course	Intelligent animation	**Aim** is to develop the ability to Express oneself creatively in the process of creating robotic systems by acquiring design skills. **Contents**: Robot actuators.Computing devices in the control system for robots and flexible production modules. Software control systems for industrial robots. Adaptive robot control systems. Robot sensitivity systems.Remote-controlled robots and manipulators. Solving software problems of applying robotic systems. **Expected result:** **Know**: industrial robot control systems; about remotely controlled robots; **Be able to**: solve programming problems using robotic systems **Possess the skills:** formation of work on the organization of processing; organization of work on the collection, storage and processing of information used in the field of professional activity
MAJORS					

Be sure to select (MSS)					
1	Fundamentals of component technologies	3	Programming languages and technologies	Programming on PHP	**Aim:** Training in modern methods and means of component programming. **Content:** Extensions to the C++ language environment C++ Builder. Additional types of data. Additional scopes. Model PME. Properties. **Expected result:** **Know:** basic concepts of technology of component-oriented programming; mechanisms for the implementation of the technology component programming in the library of visual components VCL; the principles of event-driven programming; technology user interface design of applications using a component library VCL; the hierarchy of base class library of visual components VCL, their properties and methods; purpose, properties, methods, usage characteristics, components, general purpose; ways of organizing the application's user interface. **Able to:** to analyze a subject area and choose the library classes required for the solution of applied problems; to use the tools of the integrated development environment of C++ Builder for visual development of applications. **Possess skills:** development of user interfaces of applications based on generic and specialized components, library, VCL; the implementation of the application with different user interface types.
1	Component technologies and distributed software development	3	Programming languages	Web programming	**Aim:** Acquaintance with the concepts of distributed information system, distributed information processing, as well as the principles and problems of this subject area. **Content:** Main mechanisms of distributed object technologies. The problem of integration in distributed applications. Internet technologies when creating distributed applications. **Expected result:** **Know:** main types of distributed applications; modern development technologies and development of distributed applications; main distributed object technologies and architectures (service-oriented architecture, component architecture, agent architecture, CORBA architecture). **Able to:** develop distributed applications using socket technologies, remote procedure calls, component models, CORBA, web services; select the development technology based on the specifics of the application. **Possess skills:** development of distributed applications of different types;

					the use of object-oriented programming in distributed systems.
2	Information security and information safety	5	Information theory	Technologies of distributed systems	**Aim:** Formation of students ' knowledge system in the field of information security and practical application of methods of information security. **Content:** Information security of computing systems, a multilevel protection of corporate networks; protection of information in networks; the requirements of the information security systems **Expected result:** **Know:** about protection of information of computer systems, the main subsystems of the computer, which cover concepts such as system highways, internal and external memory; requirements for information security systems; on the protection of corporate networks, the principles of security of information processing systems; main characteristics of cryptographic methods of information protection. **Able to:** in practice, to use means of information protection against unauthorized access and destructive software actions. **Possess skills:** access to electronic information resources, databases, libraries, archives; adaptation information resources and information technology; work with documents containing restricted information.
2	Data protection	5	Information technologies	Technologies of development of distributed information systems	**Aim:** Formation of students ' knowledge system in the field of information security and practical application of methods of information security. **Content:** Information security of computing systems, a multilevel protection of corporate networks; protection of information in networks; the requirements of the information security systems **Expected result:** **Know:** about protection of information of computer systems, the main subsystems of the computer, which cover concepts such as system highways, internal and external memory; requirements for information security systems; on the protection of corporate networks, the principles of security of information processing systems; main characteristics of cryptographic methods of information protection. **Able to:** in practice, to use means of information protection against unauthorized access and destructive software actions. **Possess skills:** access to electronic information resources, databases, libraries, archives; adaptation information resources and information technology;

					work with documents containing restricted information.
3	Microcontrollers and microprocessor systems	1	Fundamentals of robotics and artificial intelligence	Setting up, repair, optimization and maintenance of computer systems	**Aim:** Teaching students the principles of construction, functionality and architectural solutions of modern microprocessor systems (MPs), microcontrollers (MC) and personal computers, as well as the development of techniques for designing microprocessor systems. **Content:** Basics of organization and design of microprocessor systems (MPs). Architecture of microprocessors, ICS and microcontrollers (MC). Management of peripheral equipment in IPU. Data processing, management. The organization of interfaces in MPs and MK. Design of MPs Expected result: **Know:** program-logic model of microprocessor 1810BM86; modes of operation of the microprocessor 1810 BM86; principles of construction of microprocessor systems; program-logic model MCU series 1816; modes of operation of micro-computer 1816 WE48; features of the organization of system interrupts microprocessor and microcontroller 1810BM86 1816BE48; organization of memory of 1816 series microcontrollers. **Able to:** to build microprocessor systems on the basis of sets of 1816 and 1810; to test the microprocessors in computers **Possess skills:** composing electronic circuits for the operation of microprocessors and how to incorporate
3	Fundamentals of microprocessor technics	1	Robotic systems and complexes	Maintenance and repair of computer systems and complexes	**Aim:** Familiarize students with the classification of microprocessor systems (MPs), basic architectures of MPs, functional units and the principle of the processor, by studying the architecture, command systems, the order of work with the main peripherals and subsystems of a particular single-chip RISC microcontroller, to consolidate the basic theoretical provisions **Content:** Overview of MK families AVR. The basics of programming in assembler, AVR MC. Familiarity with peripheral devices in the MC AVR. **Expected result:** **Know:** principles of construction of electronic devices on the basis of modern element base and MPs; principles of functioning of electronic devices on the basis of modern element base and MPs; main technical parameters, performance characteristics and application fields of the main

					devices and functional units of electronics and MPs; the basic principles of designing circuits on the basis of the IPU. **Able to:** to perform the design and calculation of standard units of MEAs; to make a choice of MPs to the required task. **Possess skills:** perform analysis and synthesis of electronic circuits with MPs; of design and analysis of electronic devices with the help of computers.
4	Artificial intelligence systems	5	Fundamentals of robotics and artificial intelligence	The use of data in machine learning Internet of things	**Aim:** Formation of the system of the base view, the primary knowledge, abilities and skills of students in fundamentals of engineering and neuroinformatics. **Content:** History of artificial intelligence. Concepts of applied systems of artificial intelligence. The logic of predicates of first order. Semantic network. **Expected result:** **Know:** main theoretical and practical skills of system programming at the level of program development, allowing to obtain modern programs of complex logical structure at the lowest cost; about the composition and principles of PC management systems and networks; the appointment of components of the operating system; the principles of functioning of the various elements of the operating systems interaction; generation and processing of processes in the system; main methods and principles of programming in modern operating systems; main concepts such as: kernel objects, processes, threads, priorities, security attributes, heaps, mutexes, semaphores. **Able to:** to develop programs: covering issues of system software. **Possess skills:** skills of working with different operating systems and their administration; languages procedural and object-oriented programming, skills development and debugging of programs by no less than one of algorithmic procedural programming languages of high level.
4	Intelligent animation	5	Robotic systems and complexes	Introduction to machine learning and data analysis Design of Distributed Control Systems	**Aim:** Formation of the system of the base view, the primary knowledge, abilities and skills of students in fundamentals of engineering and neuroinformatics. **Content:** History of artificial intelligence. Concepts of applied systems of artificial intelligence. Animation. The types of animation. Intelligent animation. The creation of short films. **Expected result:** **Know:**

					history of artificial intelligence. about applied systems of artificial intelligence. all kinds of animation. **Able to:** navigate in different types of intelligent systems; to navigate and the various knowledge representation methods, to go from one method to another; formalize the knowledge of experts using different methods of knowledge presentation; create short films. **Possess skills:** the development of production knowledge bases for solving the problem of choice of options in poorly formalized subject area; applications of basic neural network models.
5	Software in business	5	Programming on 1C	Preparing theses	**Aim:** Form an understanding of the process of creating a viable startup among students - potential entrepreneurs, practical skills in the field of Internet project management and the development of small businesses in the Internet segment. **Content:**Types of technology businesses and Internet businesses. Development stages of a startup. Technological entrepreneurship. Business model. Marketing communications. Statement of sales. PR startup. **Expected result:** **Know:** the basic concepts of automated data processing in business processes; general composition and structure of personal computers and computing systems; composition, functions and possibilities of using information and telecommunication technologies in business; methods and means of gathering, processing, storage, transmission and accumulation of information; underlying system software products and packages of applied programs in the field of professional activities; main methods and techniques of information security. **Able to:** to use technology for the collection, distribution, storage, accumulation, conversion and transmission of data in a professionally oriented information systems; use various types of software, including special software, in professional activities.; to use computer and telecommunication resources. **Possess skills:** technology for the collection, distribution, storage, accumulation, conversion and transmission of data in a professionally oriented information systems.
5	Fundamentals of Internet Business	5	Database design	Preparing theses	**Aim:** Familiarize students with the models and tools of entrepreneurs in relation to enterprises operating in the Internet sphere. **Content:** Introductory motivational lecture: technological entrepreneurship. Business model.

					Marketing communications. Statement of sales. PR startup. **Expected result:** **Know:** practice of organization of work of the enterprise in the online sphere; specific features of consumer behavior and marketing aspects of Internet entrepreneurship; market research and analysis tools; main business models of companies working in the Internet sphere. **Able to:** conduct a business activity in companies of high-tech sectors; to develop and implement the business model. **Possess skills:** the use of methods, techniques, tools to create an Internet company; planning and assessing the business activities in the Internet sphere.
6	Internet of things	3	Artificial intelligence systems	Preparing theses	**Aim:** Formation of students ' knowledge about programming Internet applications for business, mastering the basic capabilities of HTML, JavaScript and PHP languages for programming websites and web interfaces. **Content:** Design and creation of a modern web-site. Web-design and browsers. The hypertext markup language HTML pages. Making a Web page available. Presentation of text on Web pages. The representation of graphics on Web pages. Web server. Create fixed and flexible Web pages. MacromediaFlash. The strategy of development of the Web site **Expected result:** **Know:** basic principles and technologies of the global Internet computer network organization; fundamentals of construction and operation of Internet application services; main technologies of applied programming for the Internet**.** **Able to:** to determine the section of the network with the maximum transmission delay of IP packets; to form HTTP requests and parse the fields in the HTTP response; develop hypertext documents. **Possess skills:** methods and development of web applications using hypertext markup languages HTML and XHTML, cascading style sheets CSS, JavaScript, PHP; methods of organization of local computer networks; technologies to protect Internet applications from the point of view of information security.
6	Design of Distributed Control Systems	3	Intelligent animation	Preparing theses	**Aim:** Development of the concept and methodology of analysis and synthesis of complex systems, design principles of information systems **Content:** Phases and stages of designing SU. Sketch design. Analysis and synthesis of data processing systems. Synthesis and analysis of

					the control system. Measures to assess the quality of the designed system. Synthesis of XOIU. **Expected result:** **Know:** properties, characteristics and architecture (structure and topology) of distributed control and automation systems (DCS), types of support {methodical, technical, software, informational, metrological, ergonomic, organizational and legal); functional objectives and performance criteria of DCS. **Able to:** to carry out projects of means of automation, systems of automation of technological processes: perform automation of research and testing: design and implement algorithms for preprocessing information (compression, filtering, improving the accuracy of conversion, etc.).), Build modern control algorithms (modal, neuro-fuzzy, network - centric, etc.). to determine the section of the network with the maximum transmission delay of IP packets; to form HTTP requests and parse the fields in the HTTP response; develop hypertext documents. **Possess skills:** implementation of formal construction and transformation of analytical and simulation models of DCS; the application of methods and techniques for the analysis and synthesis of RSU architectures; development and use of analytical and simulation models of DCS for evaluation of design solutions; implementation of the sequence of design stages of control and automation systems.
7	Programming on PHP	5	Fundamentals of component technologies Object-oriented programming in C++	Preparing theses	**Aim**: currently, - one of the most popular languages for the implementation of web applications. This course is devoted to the study of its basics. The emphasis is on the practical application of the acquired skills. PHP language was created to solve a specific practical problem in the Internet environment. Familiarity with the PHP language, development of skills in design and programming of web applications. **Contents**: Discusses how to separate statements, create comments, variables, constants and data types, operators. Conditional statements (if, switch), working with loops (while, for, foreach) and using include, require functions. **Expected result:** **Know:** - principles of Internet services; **Able to:** - create static and dynamic pages. **Possess skills:** - programming and client-server technologies.

7	Web programming	5	Component technologies and distributed software development Functional programming	Preparing theses	**Aim**: the Discipline "Web-programming" aims to learn the basics of Java programming and basic concepts that allow students to get a basic understanding of effective ways to develop Web applications, along with the acquisition of practical skills **Contents**: introductory lecture. The subject of the course, the emergence and development of Java. Java virtual machine. Algorithmic tools of the Java language. Vocabulary of the language. Data type. Operations. Control structures. Naming rules. Packages. Objects and classes. **Expected result:** **Know:** - static web-site development technologies; - methods of using multimedia (graphics, video, animation) on web-pages; - client-side software tools used to create web pages; **Able to:** - design and develop the structure of the site; - use HTML hypertext markup language and cascading style sheets (CSS) to create web pages; - develop scripts in the JavaScript programming language; **Possess skills:** - creation of web-sites; - placement of the web-site on the server and its maintenance; - registration of the site in search engines.
8	Technologies of distributed systems	5	Information security and information safety	Preparing theses	**Aim:** Reveal the essence of distributed computing technology, principles and technology of distributed databases, to describe the technologies and models of "Client-server" used in modern enterprises **Content:** Distributed computing Technologies. Distributed database. Client-server technologies and models». Object data binding technologies. Data replication technologies **Expected result:** **Know:** principles of distributed information processing systems construction; distribution database; Client-server network technology and models»; technology object data binding. **Able to:** to use technology in development and maintenance of distributed information systems. **Possess skills:** works with modern systems of design and development of distributed systems.
8	Technologies of development of distributed information systems	5	Data protection	Preparing theses	**Aim:** Theoretical and practical training of students in the field of information technology to the extent that they can choose the necessary technical, algorithmic, software and technological solutions, Able to explain the principles of their operation and use them correctly. **Content:** Communication in distributed systems. Remote procedure call. Safety. Link type. Distributed transaction. The notion of a

					transaction. The ACID principle. Nested transaction. Distributed transaction. **Expected result:** **Know:** principles of distributed information processing systems construction; communication in distributed systems; link type; the notion of a transaction. **Able to:** to use technologies of construction and operation of the distributed information systems. **Possess skills:** works with modern systems of design and development of distributed systems
9	Software development technology	6	Setting up, repair, optimization and maintenance of computer systems	Preparing theses	**Aim:** Study of software classification, tools and methods of software tools, tools and methods of detection, processing tools and compilation, download, installation of software characteristics of devices, their information support, support and implementation of software, the practical application of modern processing tools. **Content:** Introduction. State and foreign normative documents, determination of treatment composition. RUP. Processing of applications. DC. The tools and techniques of logical design. UML. Description of processing functionality. The tools and techniques. Create a cluster diagram. Methods, technologies, tools. Define language processing, determine the propagation medium and determine the processing tools. Physical design procedure-order, tool, resource, documentation Tools for visual programming with MS VisualStudio, BorlandDelphi and others. Selection and editing of components, machining of components. Open the API TOOL. The repair software. Tooling. Repair method. Testing. Variants and examples of tests. Selection and editing of components, machining of components. Open the API TOOL. The creation of a software interface. The principles of processing tool. Methods for creating interfaces and tools. Optimize processing time and size. The tools and techniques. Create help. The tools and techniques. Principles of software development and protection. Principles of software development. **Expected result:** **Know:** modern trends in computer science, computer technology; basis of creation of information systems and use of new information technologies of information processing; life cycle of the software; object-oriented programming; theories and methods of classification; elements of complexity theory. **Able to:** use mathematical methods, physical laws and

					computational techniques to solve practical problems; program in one of algorithmic languages; to apply algorithms of information retrieval IN software development. **Possess skills:** drafting of projects for the development of modern software; technologies of data collection, processing, transmission and storage.
9	Software development process	6	Maintenance and repair of computer systems and complexes	Preparing theses	**Aim:** Study the classification, life cycle, technology rapid software development. **Content:** Life cycle of the software. Identification of requirements for the software system. Work with customers. Review of software design methodologies. Fast software development technologies. Object-oriented design of a software system. Information support tools for software projects and products (CALS) technologies. Testing and debugging of software systems. Assessment of the quality of the software. Implementation and maintenance of software products **Expected result:** **Know:** theoretical basis of software tools; classical and modern methods of building the information structure and interface of the tool. **Able to:** select tools when creating software; to apply the standards of construction of the software; to assess the effectiveness of tools and the analysis of qualitative characteristics; realize the economic efficiency of the software; to apply object-oriented and structured methods of distribution in control and measuring instruments. **Possess skills:** software development hard; comparative analysis of selection tools.

LIST OF COMPONENTS BY CHOICE
for an educational program
«6B06124 «Computational technology and software»
Form of training: Full – time
Training period: 2 years (DOT)

Group of educational program: 5B057- Information technologies

№	Name of discipline	Code of discipline	Number of credits	Semester
2. General educational disciplines				
1	**Component on a choice 1**			
	Introduction to specialty	IS 2212	6	1
	Basics of work on a personal computer	BWPC 2212		
2	**Component on a choice 2**			
	Information theory	IT 2214	5	2
	Information technologies	IT 2214		
3	**Component on a choice 3**			
	Probabilities theory and Math statistics	PTMS 1216	3	1
	Discrete Math	DM 1216		
4	**Component on a choice 4**			
	Operating systems	OS 3217	5	2
	Operating systems, environments and shells	OSES 3217		
5	**Component on a choice 5**			
	Programming languages and technologies	PLT 3218	5	2
	Programming languages	PL 3218		
6	**Component on a choice 6**			
	Object-oriented programming in C++	OOPC 3220	5	3
	Functional programming	FP 3220		
7	**Component on a choice 7**			
	Setting up, repair, optimization and maintenance of computer systems	SROMCS 3221	4	3
	Maintenance and repair of computer systems and complexes	MRCSC 3221		
8	**Component on a choice 8**			
	Programming on 1C	P1C 4222	2	3
	Database design	DD 4222		
12	**Component on a choice 12**			
	Computer modeling	CM 4223	5	3
	Mathematical and computer modeling	MCM 4223		
13	**Component on a choice 13**			
	Modern methods and means of Java programing	MMMJP 4224	3	4
	Modern methods and means of NET programing	MMMNP 4224		
14	**Component on a choice 14**			
	The use of data in machine learning	TUDML 4225	3	4
	Introduction to machine learning and data analysis	TMLDA 4225		

	Component on a choice 15			
15	Fundamentals of robotics and artificial intelligence	FRAI 4227	5	1
	Robotic systems and complexes	RSC 4227		
3. The main subjects				
	Component on a choice 1			
1	Fundamentals of component technologies	FCT 2305	3	3
	Component technologies and distributed software development	CTDSD 2305		
	Component on a choice 2			
2	Information security and information safety	ISIS 3306	5	3
	Information security	IS 3306		
	Component on a choice 3			
3	Microcontrollers and microprocessor systems	MMS 3307	1	2
	Fundamentals of microprocessor technics	FMT 3307		
	Component on a choice 4			
4	Artificial intelligence systems	AIS 3308	5	3
	Intelligent animation	IA 3308		
	Component on a choice 5		5	
5	Software in business	SB 3309		4
	Fundamentals of Internet Business	FIB 3309		
	Component on a choice 6			
6	Internet of things	IT 3310	3	4
	Design of Distributed Control Systems	DDCS 3310		
	Component on a choice 7			
7	Programming on PHP	PPHP 4311	5	4
	Web programming	WP 4311		
	Component on a choice 8			
8	Technologies of distributed systems	TDS 4312	5	4
	Technologies of development of distributed information systems	TDDIS 4312		
	Component on a choice 9			
9	Software development technology	SDT 4313	6	4
	Software development process	SDP 4313		