

**MINISTRY OF AGRICULTURE OF THE REPUBLIC OF KAZAKHSTAN  
"NJSC "S. SEIFULLIN KAZAKH AGROTECHNICAL UNIVERSITY"**

Approve  
NJSC "Saken Seifullin Kazakh  
Deputy Chairman of the Management  
Board Academic Activity-Rector  
\_\_\_\_\_ A.M Abdyrov.  
« \_\_\_\_\_ » \_\_\_\_\_ 2021.

**CATALOG OF ELECTIVE COURSES**

For students in groups of educational programs

Computer Engineering

**Nur-Sultan, 2021**

**MINISTRY OF AGRICULTURE OF THE REPUBLIC OF KAZAKHSTAN  
"NJSC "S. SEIFULLIN KAZAKH AGROTECHNICAL UNIVERSITY"**

Brief description of elective disciplines of the educational program

Veterinary Management

|    |                      |   |
|----|----------------------|---|
| 1  | Name of course       | Design Database Oracle I,II   |
| 2  | Code of course       | "DDO 2216 and DDOI 2217"  |
| 3  | Cycle of course      | BS  |
| 4  | Amount of credits    | 9   |
| 5  | Level of preparation | Undergraduate studies   |
| 6  | Department           | Computer Engineering and Software   |
| 7  | Year                 | 2   |
| 8  | Prerequisites        | Algorithms and data structures  |
| 9  | Postrequisites       | Object-oriented programming in C #, Development of applications in Python, Development of applications in Java  |
| 10 | Course summary       | Database models. Database Design. Normalization of relationships. The method of decomposition, entities and relationships. Building an information and logical data model. Developmentenvironment of theORACLE DB . Creating a database, queries to extract data. Calculations and summing up in queries.Modification requests, data integrity. Transactions and blocking. Form Development Data processing. Report development.Development of user applications. |
| 11 | Learning outcomes    | Can distinguish database model. Can use programming languages to create databases.  |

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|----|----------------------|---|
| 1  | Name of course       | Designing SQL Database I,II   |
| 2  | Code of course       | "DSD 2215 DSDI 2218"  |
| 3  | Cycle of course      | Base requirements(BS)   |
| 4  | Amount of credits    | 9   |
| 5  | Level of preparation | Undergraduate studies   |
| 6  | Department           | Computer Engineering and Software   |
| 7  | Year                 | 2   |
| 8  | Prerequisites        | Algorithms and data structures  |
| 9  | Postrequisites       | Object-oriented programming in C #, Development of applications in Python, Development of applications in Java  |
| 10 | Course summary       | Database models.Database Design.Normalization of relationships. The method of decomposition, entities and relationships. Building an information and logical data model. MYSQL DB development environment.Database creation , queries for data extraction.Calculations and summing up in queries.Modification requests, data integrity. Transactions and blocking. Form Development Data processing. Report development.Development of user applications. |
| 11 | Learning outcomes    | Can distinguish database model. Can use programming languages to create databases.  |

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|----|----------------------|---|
| 1  | Name of course       | Programming in Python   |
| 2  | Code of course       | PYaP 3221   |
| 3  | Cycle of course      | Base requirements(BS)   |
| 4  | Amount of credits    | 6   |
| 5  | Level of preparation | Undergraduate studies   |
| 6  | Department           | Computer Engineering and Software   |
| 7  | Year                 | 3   |
| 8  | Prerequisites        | Algorithms and data structures  |
| 9  | Postrequisites       | Development of software applications by Python tools (part 1,2)   |
| 10 | Course summary       | The programming language alphabet, data input / output, data types, syntax and control programming constructs: linear, branching, cycle, recursion. Data structures: lists, array, trees, tuples, dictionaries, sets, files.Classes. Modules and packages. Libraries. |
| 11 | Learning outcomes    | Get an idea of modern perspectives and development trends of web technologies; Know and understand the principles organization, functioning information processing technologies in Internet; Acquire practical skills in creation and maintenance of web applications |

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| 1 | Name of course | Programming in Java |
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|----|----------------------|---|
| 2  | Code of course       | PYaJ 3219   |
| 3  | Cycle of course      | Base requirements(BS)   |
| 4  | Amount of credits    | 6   |
| 5  | Level of preparation | Undergraduate studies   |
| 6  | Department           | Computer Engineering and Software   |
| 7  | Year                 | 2   |
| 8  | Prerequisites        | Algorithms and data structures  |
| 9  | Postrequisites       | Java application development (part 1,2)   |
| 10 | Course summary       | The programming language alphabet, data input / output, data types, syntax and control programming constructs: linear, branching, cycle, recursion. Data structures: lists, array, trees, sets, files. Classes. Modules and packages. Libraries.  |
| 11 | Learning outcomes    | Develop, describe and explain the algorithm for solving the problem, determine the structure of the problem: a linear, branched and cyclic, interpret the data structure: lists, arrays, sets, files, strings, etc. Explain to choose and use a "top down" programming and ". bottom-up "master practical skills of programming in a programming language, to show differences in the syntax of programming languages and their features, principles of programming, structure and types of programming, applying s expertise in application development; tabled in the difficult areas of application development, to show a complete picture of the problem to analyze the problem, identify solutions and to select efficient algorithms for the task. Allocate the input and output data. Understand the integrity of the developed software. Select tools and programming language for the effective implementation of the software. Develop (write program code to determine the design, verifitsirovat, test, etc.) complete the application database, Web portals, individual modules to them, to integrate the modules in the application. |

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|---|-------------------|---|
| 1 | Name of course    | Development of software applications by Python tools (part 1) |
| 2 | Code of course    | RPPSPCh 3224  |
| 3 | Cycle of course   | Base requirements(BS)   |
| 4 | Amount of credits | 7   |

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| 5  | Level of preparation | Undergraduate studies   |
| 6  | Department           | Computer Engineering and Software   |
| 7  | Year                 | 3   |
| 8  | Prerequisites        | Programming in Python   |
| 9  | Postrequisites       | Pattern recognition   |
| 10 | Course summary       | Classes. Inheritance. Encapsulation. Creation of modules and independent exe-applications. Software tools for developing applications. Creating applications with GUI (applets and window applications). Creating applications for working with databases. Use of technology programming languages. Review of graphic libraries. Developing Webapplications.  |
| 11 | Learning outcomes    | PO3-Develop, describe and explain the algorithm for solving the problem, determine the structure of the problem a linear, branched and cyclic, interpret the data structure: lists, arrays, sets, files, strings, etc. Explain to choose and use a "top down" programming and ". bottom-up "master practical skills of programming in a programming language, to show differences in the syntax of programming languages and their features, principles of programming, structure and types of programming, applying s expertise in application development; tabled in the difficult areas of application development, to show a complete picture of the problem PO 4 - to analyze the problem, identify solutions and to select efficient algorithms for the task. Allocate the input and output data. Understand the integrity of the developed software. Select tools and programming language for the effective implementation of the software. Develop (write program code to determine the design, verefitsirovat, test, etc.) complete the application database, Web portals, individual modules to them, to integrate the modules in the application. |

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|---|----------------------|---------------------------------------|
| 1 | Name of course       | Object-oriented design of C #         |
| 2 | Code of course       | OOPS 3220                             |
| 3 | Cycle of course      | Base requirements(BS)                 |
| 4 | Amount of credits    | 6                                     |
| 5 | Level of preparation | Undergraduate studies                 |
| 6 | Department           | Computer Engineering and Software     |
| 7 | Year                 | 3                                     |
| 8 | Prerequisites        | Algorithms and data structures        |
| 9 | Postrequisites       | C# application development (part 1,2) |

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| 10 | Course summary    | The programming language alphabet, data input / output, data types, syntax and control programming constructs: linear, branching, cycle, recursion. Data structures: lists, array, trees, pointers, sets, files. Classes. Modules and packages. Libraries.   |
| 11 | Learning outcomes | Develop, describe and explain the algorithm for solving the problem, determine the structure of the problem: a linear, branched and cyclic, interpret the data structure: lists, arrays, sets, files, strings, etc. Explain to choose and use a "top down" programming and ". bottom-up "master practical skills of programming in a programming language, to show differences in the syntax of programming languages and their features, principles of programming, structure and types of programming, applying s expertise in application development; tabled in the difficult areas of application development, to show a complete picture of the problem. To analyze the problem, identify solutions and to select efficient algorithms for the task. Allocate the input and output data. Understand the integrity of the developed software. Select tools and programming language for the effective implementation of the software. Develop (write program code to determine the design, verefitsirovat, test, etc.) complete the application database, Web portals, individual modules to them, to integrate the modules in the application. |

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|----|----------------------|--|
| 1  | Name of course       | C# application development (part 1,)   |
| 2  | Code of course       | RPSC# 3226   |
| 3  | Cycle of course      | Base requirements(BS)  |
| 4  | Amount of credits    | 7  |
| 5  | Level of preparation | Undergraduate studies  |
| 6  | Department           | Computer Engineering and Software  |
| 7  | Year                 | 3  |
| 8  | Prerequisites        | Object-oriented design of C #  |
| 9  | Postrequisites       | Driver programming for OS, Pattern recognition   |
| 10 | Course summary       | Classes. Inheritance. Encapsulation. Creation of modules and independent exe-applications. Software tools for developing applications. Creating applications with GUI (applets and window applications). Creating applications for working with databases. Use of technology programming languages. Review of graphic libraries. Developing Webapplications. |

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| 11 | Learning outcomes | Develop, describe and explain the algorithm for solving the problem, determine the structure of the problem a linear, branched and cyclic, interpret the data structure: lists, arrays, sets, files, strings, etc. Explain to choose and use a "top down" programming and ". bottom-up "master practical skills of programming in a programming language, to show differences in the syntax of programming languages and their features, principles of programming, structure and types of programming, applying s expertise in application development; tabled in the difficult areas of application development, to show a complete picture of the p to analyze the problem, identify solutions and to select efficient algorithms for the task. Allocate the input and output data. Understand the integrity of the developed software. Select tools and programming language for the effective implementation of the software. Develop (write program code to determine the design, verefitsirovat, test, etc.) complete the application database, Web portals, individual modules to them, to integrate the modules in the application. |
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|----|----------------------|---|
| 1  | Name of course       | Development of software applications by Python tools (part 2)   |
| 2  | Code of course       | RPPSPCh 3227  |
| 3  | Cycle of course      | Base requirements(BS)   |
| 4  | Amount of credits    | 6   |
| 5  | Level of preparation | Undergraduate studies   |
| 6  | Department           | Computer Engineering and Software   |
| 7  | Year                 | 3   |
| 8  | Prerequisites        | Programming in Python   |
| 9  | Postrequisites       | Pattern recognition   |
| 10 | Course summary       | Classes. Inheritance. Encapsulation. Creation of modules and independent exe-applications. Software tools for developing applications. Creating applications with GUI (applets and window applications). Creating applications for working with databases. Use of technology programming languages. Review of graphic libraries.Developing Webapplications.   |
| 11 | Learning outcomes    | To analyze the problem, identify solutions and to select efficient algorithms for the task. Allocate the input and output data. Understand the integrity of the developed software. Select tools and programming language for the effective implementation of the software. Develop (write program code to determine the design, verefitsirovat, test, etc.) complete the application database, Web portals, individual modules to them, to integrate the modules in the application. |



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|----|----------------------|---|
| 1  | Name of course       | Machine-oriented programming on Assembler /C/C++  |
| 2  | Code of course       | MOPA 3307, MOPS 3308  |
| 3  | Cycle of course      | Profession requirements(VRS)  |
| 4  | Amount of credits    | 5   |
| 5  | Level of preparation | Undergraduate studies   |
| 6  | Department           | Computer Engineering and Software   |
| 7  | Year                 | 3   |
| 8  | Prerequisites        | Modern computer architecture  |
| 9  | Postrequisites       | Operating systems and system programming  |
| 10 | Course summary       | The concept of machine-oriented programming (MOS). Means of interaction MOS with the operating system (OS). The basic processor architecture. RAM. Registers. Presentation of data. Submission of teams. Ways of addressing. Programming linear processes. Arithmetic commands. Interrupts I/O system. BIOS functions for working with the console. MS DOS functions for working with the console.  |
| 11 | Learning outcomes    | Describe the architecture of computer systems, computer work parallel systems, classified computer systems on the processor type, on the principle of shared memory; to explain the idea of parallelization on multi-core processors. Install and maintain operating systems. Stake (amount) judgment of modernization architecture COP, install and replace the internal and external computer device. Select the programming language for computer hardware. Make programs for microprocessors, microcontrollers. To be able to program individual instruction blocks in microcontrollers and microprocessors, determine a relationship of the microcontroller / microprocessor with external devices in equipments APC. Check the protection of information in computer systems. Choose methods of information protection from outside intruders. Use programming encryption algorithms, to develop programs for encoding and decoding data. To be able to create anti-virus programs. |

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|----|----------------------|---|
| 1  | Name of course       | Driver programming for OS   |
| 2  | Code of course       | PDDO 4314   |
| 3  | Cycle of course      | Profession requirements(VRS)  |
| 4  | Amount of credits    | 5   |
| 5  | Level of preparation | Undergraduate studies   |
| 6  | Department           | Computer Engineering and Software   |
| 7  | Year                 | 4   |
| 8  | Prerequisites        | Operating systems and system programming  |
| 9  | Postrequisites       | Neural networks, Intelligent sensors  |
| 10 | Course summary       | Basic driver development concepts. Windows architecture . WDM architecture. Kernel mode programming. Driver structure. Writing, compiling, installing, debugging the driver. Driver for printer, display, video card, Multiprocessor programming paradigm. Writing 64-bit drivers and drivers for multiprocessor systems.   |
| 11 | Learning outcomes    | Describe the system application software and operating system drivers to explain the source code of the existing device drivers to use the basics of programming language, competently use a set of tools for developing drivers. When programming, use the principles of parallel programming, Select and use appropriate language for programming of microprocessors and microcontrollers. Comparing devices microprocessors and microcontrollers. Called types of sensors and smart sensors, to describe the basic elements of intelligent sensors that use neural networks, fundamentals of robotic systems. Demonstrate knowledge of intelligent systems in an automated system in agriculture, in industry, in the production. To make decisions in case of breakage devices and judiciously solve the problem; to plan actions for the use of new devices and the programming of these devices. Define the principles slaves in the neural network, in robotics. |

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|----|----------------------|---|
| 1  | Name of course       | Principles of parallel programming  |
| 2  | Code of course       | PPP 4313  |
| 3  | Cycle of course      | Profession requirements(VRS)  |
| 4  | Amount of credits    | 5   |
| 5  | Level of preparation | Undergraduate studies   |
| 6  | Department           | Computer Engineering and Software   |
| 7  | Year                 | 4   |
| 8  | Prerequisites        | Algorithms and data structures  |
| 9  | Postrequisites       | Neural networks, Intelligent sensors  |
| 10 | Course summary       | Architecture of parallel computers. Methods of parallel data processing. Parallelism and its use. Graphs of informational dependencies. OpenMP programming technology . MPI programming technology. Introduction to CUDA technology. GPU architecture. CUDA software model. Memory hierarchy in CUDA. Hybrid parallel programming model   |
| 11 | Learning outcomes    | Describe the system application software and operating system drivers to explain the source code of the existing device drivers to use the basics of programming language, competently use a set of tools for developing drivers. When programming, use the principles of parallel programming. Select and use appropriate language for programming of microprocessors and microcontrollers. Comparing devices microprocessors and microcontrollers. Called types of sensors and smart sensors, to describe the basic elements of intelligent sensors that use neural networks, fundamentals of robotic systems. Demonstrate knowledge of intelligent systems in an automated system in agriculture, in industry, in the production. To make decisions in case of breakage devices and judiciously solve the problem; to plan actions for the use of new devices and the programming of these devices. Define the principles slaves in the neural network, in robotics. |

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|----|----------------------|--|
| 1  | Name of course       | C# application development (part 2)  |
| 2  | Code of course       | RPSCh 3228   |
| 3  | Cycle of course      | Base requirements(BS)  |
| 4  | Amount of credits    | 6  |
| 5  | Level of preparation | Undergraduate studies  |
| 6  | Department           | Computer Engineering and Software  |
| 7  | Year                 | 3  |
| 8  | Prerequisites        | Object-oriented design of C #  |
| 9  | Postrequisites       | Driver programming for OS, Pattern recognition   |
| 10 | Course summary       | Classes. Inheritance. Encapsulation. Creation of modules and independent exe-applications. Software tools for developing applications. Creating applications with GUI (applets and window applications). Creating applications for working with databases. Use of technology programming languages. Review of graphic libraries. Developing Webapplications.   |
| 11 | Learning outcomes    | PO3-Develop, describe and explain the algorithm for solving the problem, determine the structure of the problem: a linear, branched and cyclic, interpret the data structure: lists, arrays, sets, files, strings, etc. Explain to choose and use a "top down" programming and ". bottom-up "master practical skills of programming in a programming language, to show differences in the syntax of programming languages and their features, principles of programming, structure and types of programming, applying s expertise in application development; tabled in the difficult areas of application development, to show a complete picture of the problem PO 4 - to analyze the problem, identify solutions and to select efficient algorithms for the task. Allocate the input and output data. Understand the integrity of the developed software. Select tools and programming language for the effective implementation of the software. Develop (write program code to determine the design, verefitsirovat, test, etc.) complete the application database, Web portals, individual modules to them, to integrate the modules in the application. |

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|---|----------------|----------------------------|
| 1 | Name of course | Basics of Cisco Networking |
| 2 | Code of course | OOSC 3306                  |

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| 3  | Cycle of course      | Profession requirements(VRS)   |
| 4  | Amount of credits    | 5  |
| 5  | Level of preparation | Undergraduate studies  |
| 6  | Department           | Computer Engineering and Software  |
| 7  | Year                 | 3  |
| 8  | Prerequisites        | Operating systems and system programming, Modern computer architecture   |
| 9  | Postrequisites       | Neural networks, Intelligent sensors   |
| 10 | Course summary       | Basics of network technologies. General principles of networking. Network solutions from CISCO. Operating system (IOS). OSI model. Standard communication protocol stacks. Network model of the Cisco . Network communication tools. Network adapters. Network structuring methods. IPv6 protocol. Package format Types of addresses. Cisco routers: configure RIPng, diagnose problems. Security corporate networks. Security Management.   |
| 11 | Learning outcomes    | Describe the concept of a computer network. Enumerate the layers of the OSI reference model and their purpose. Explain and to give specific examples of the principle construction of LAN, wireless data transmission operation of virtual network address in the stack TCP / IP protocol. Describe the computer system of physical objects ("things"), equipped with built-in technologies to interact with each other and the environment. Construct WLAN, a virtual network, a client server network. Configure the switch and router for networking. Perform network administration. To justify action on the network using IoT network technologies in the workplace, in industry, in agriculture. To choose and configure the device for constructing a specific network |

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|---|----------------------|-----------------------------------|
| 1 | Name of course       | IT Management Methodology         |
| 2 | Code of course       | MUIP 4315                         |
| 3 | Cycle of course      | Profession requirements(VRS)      |
| 4 | Amount of credits    | 5                                 |
| 5 | Level of preparation | Undergraduate studies             |
| 6 | Department           | Computer Engineering and Software |

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|----|-------------------|---|
| 7  | Year              | 4   |
| 8  | Prerequisites     | philosophy  |
| 9  | Postrequisites    | Topics diploma and course works   |
| 10 | Course summary    | Definition of project objectives, preparation of project justification, its structuring, determination of financial needs and sources of financing; selection of suppliers, contractors and other performers, preparation and conclusion of contracts; calculation of the budget and budget of the project, determination of the timing of the project and the development of the implementation schedule, risk management in the project; monitoring the progress of the project.  |
| 11 | Learning outcomes | Describe the database model, list the steps of database design and explain what happens at each stage of the design, to explain and normalize database; The use of modern database management systems, to integrate them into applications, manage databases exactly create queries to search data by various criteria, delete, add data to determine the relevance of the data in the software and hardware. Consult and unread interface to work with databases. Designing IT projects that demonstrate the software projects (software), use of software design techniques to use IT project management methodology in the process of software design, writing the terms of reference for the software to know the circuit design front-end and back-end; apply the basics of big data technologies, methods of analysis and work with big data. Database design and comply with the integrity of the database normalization. Develop client-server applications to work with big data in a professional activity. Discuss the developed product, to identify errors in the verification, testing software. Program applications for the analysis of large data. |

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|---|----------------------|---|
| 1 | Name of course       | IT project management and entrepreneurship                      |
| 2 | Code of course       | UIPP 4320   |
| 3 | Cycle of course      | Profession requirements(VRS)                                    |
| 4 | Amount of credits    | 5   |
| 5 | Level of preparation | Undergraduate studies   |
| 6 | Department           | Computer Engineering and Software                               |
| 7 | Year                 | 4   |
| 8 | Prerequisites        | Mathematical foundations in ICT, Algorithms and data structures |
| 9 | Postrequisites       | Topics diploma and course works                                 |

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| 10 | Course summary    | Project as an object of management. Types of projects. Project life cycle. Development and analysis of project requirements. Scheduling IT projects . Resource management IT projects . Risk management of IT projects . Version control and document management of IT projects . Financial and economic planning and analysis of IT projects . Stages of registration of an individual entrepreneur, work in egov . kz . Entrepreneurship structures in Kazakhstan and documentary support.  |
| 11 | Learning outcomes | Describe the database model, list the steps of database design and explain what happens at each stage of the design, to explain and normalize database; The use of modern database management systems, to integrate them into applications, manage databases exactly create queries to search data by various criteria, delete, add data to determine the relevance of the data in the software and hardware. Consult and unread interface to work with databases. Designing IT projects that demonstrate the software projects (software), use of software design techniques to use IT project management methodology in the process of software design, writing the terms of reference for the software to know the circuit design front-end and back-end; apply the basics of big data technologies, methods of analysis and work with big data. Database design and comply with the integrity of the database normalization. Develop client-server applications to work with big data in a professional activity. Discuss the developed product, to identify errors in the verification, testing software. Program applications for the analysis of large data. |

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|----|----------------------|--|
| 1  | Name of course       | Pattern recognition  |
| 2  | Code of course       | RO 4316  |
| 3  | Cycle of course      | Profession requirements(VRS)   |
| 4  | Amount of credits    | 6  |
| 5  | Level of preparation | Undergraduate studies  |
| 6  | Department           | Computer Engineering and Software  |
| 7  | Year                 | 4  |
| 8  | Prerequisites        | Algorithms and data structures   |
| 9  | Postrequisites       | Topics diploma and course works  |
| 10 | Course summary       | Digital image processing. Image processing methods: point and spatial. Image analysis on the basis of decomposition in basis functions, on the basis of wavelets . Methods of texture analysis, image compression. Binary mathematical morphology. Vectorization of discrete forms. Recognition and classification of the form. Efficient algorithms for Voronoi partitions. |

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| 11 | Learning outcomes | Describe the system application software and operating system drivers to explain the source code of the existing device drivers to use the basics of programming language, competently use a set of tools for developing drivers. When programming, use the principles of parallel programming. Select and use appropriate language for programming of microprocessors and microcontrollers. Comparing devices microprocessors and microcontrollers. Called types of sensors and smart sensors, to describe the basic elements of intelligent sensors that use neural networks, fundamentals of robotic systems. Demonstrate knowledge of intelligent systems in an automated system in agriculture, in industry, in the production. To make decisions in case of breakage devices and judiciously solve the problem; to plan actions for the use of new devices and the programming of these devices. Define the principles slaves in the neural network, in robotics. |
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|----|----------------------|---|
| 1  | Name of course       | Neural networks   |
| 2  | Code of course       | NS 4319   |
| 3  | Cycle of course      | Profession requirements(VRS)  |
| 4  | Amount of credits    | 7   |
| 5  | Level of preparation | Undergraduate studies   |
| 6  | Department           | Computer Engineering and Software   |
| 7  | Year                 | 4   |
| 8  | Prerequisites        | Mathematical foundations in ICT, Algorithms and data structures   |
| 9  | Postrequisites       | Topics diploma and course works   |
| 10 | Course summary       | Basic concepts. Artificial neural networks. Single-layer and multi - layer perceptrons . Networks based on radial basis functions. Support vector machines. Analysis of the main components of the Kohonen self-organization map . Neurodynamic models. Livshits condition. Divergence theorem  |
| 11 | Learning outcomes    | Describe the system application software and operating system drivers to explain the source code of the existing device drivers to use the basics of programming language, competently use a set of tools for developing drivers. When programming, use the principles of parallel programming. Select and use appropriate language for programming of microprocessors and microcontrollers. Comparing devices microprocessors and microcontrollers. Called types of sensors and smart sensors, to describe the basic elements of intelligent sensors that use neural networks, fundamentals of robotic systems. Demonstrate knowledge of intelligent systems in an automated system in agriculture, in industry, in the production. To make decisions in case of breakage devices and judiciously solve the problem; to plan actions for the use of new devices and the programming of these devices. Define the principles slaves in the neural network, in robotics. |



|    |                      |   |
|----|----------------------|---|
| 1  | Name of course       | Programming microcontrollers and microprocessors  |
| 2  | Code of course       | PMM 3309  |
| 3  | Cycle of course      | Additional courses  |
| 4  | Amount of credits    | 7   |
| 5  | Level of preparation | Undergraduate studies   |
| 6  | Department           | Computer Engineering and Software   |
| 7  | Year                 | 3   |
| 8  | Prerequisites        | Operating systems and system programming, Modern computer architecture  |
| 9  | Postrequisites       | Organization of computers, architecture of computer systems and special disciplines studied by choice.  |
| 10 | Course summary       | Organization of computers, architecture of computer systems and special disciplines studied by choice.  |
| 11 | Learning outcomes    | Describe the system application software and operating system drivers to explain the source code of the existing device drivers to use the basics of programming language, competently use a set of tools for developing drivers. When programming, use the principles of parallel programming. Select and use appropriate language for programming of microprocessors and microcontrollers. Comparing devices microprocessors and microcontrollers. -intelligent sensors that use neural networks, fundamentals of robotic systems. Demonstrate knowledge of intelligent systems in an automated system in agriculture, in industry, in the production. To make decisions in case of breakage devices and judiciously solve the problem; to plan actions for the use of new devices and the programming of these devices. Define the principles slaves in the neural network, in robotics. |

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|----|----------------------|---|
| 1  | Name of course       | Designing digital devices   |
| 2  | Code of course       | PCU 3310  |
| 3  | Cycle of course      | Profession requirements(VRS)  |
| 4  | Amount of credits    | 5   |
| 5  | Level of preparation | Undergraduate studies   |
| 6  | Department           | Computer Engineering and Software   |
| 7  | Year                 | 3   |
| 8  | Prerequisites        | Mathematical foundations in ICT, Physics, Algorithms and data structures  |
| 9  | Postrequisites       | Cybersecurity, Mesh shielding   |
| 10 | Course summary       | Basic concepts of digital technology. Fundamentals of the algebra of logic. Digital devices of combination type. Digital devices of sequential type. Designing digital devices. CAD/CAM systems classification . Analysis and synthesis of digital devices of combinational type and sequential type. Calculation and design of digital devices.  |
| 11 | Learning outcomes    | Understanding the circuitry of electronic devices in the computer, choose the machine programming languages for programming electronic devices, describe the design and operation logic integrated devices in the computer chip to store the results of logical connections in chips, roughly calculate the result obtained, display circuitry devices (encoders, decoders, encoders, decoders , transistors) computer system. Define requirements for the designed integrated circuits, to argue their work. |

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|----|----------------------|---|
| 1  | Name of course       | Fundamentals of robotics  |
| 2  | Code of course       | OR 4317   |
| 3  | Cycle of course      | Profession requirements(VRS)  |
| 4  | Amount of credits    | 7   |
| 5  | Level of preparation | Undergraduate studies   |
| 6  | Department           | Computer Engineering and Software   |
| 7  | Year                 | 4   |
| 8  | Prerequisites        | Mathematical foundations in ICT, Algorithms and data structures   |
| 9  | Postrequisites       | Topics diploma and course works   |
| 10 | Course summary       | Basic concepts of robotics. Principles of the use of robots in the industry. Methods for representing coordinate systems in space used in robotics, and transitions between coordinate systems. Dynamics of manipulators. The basic principles of roboetics and the interaction of man and robot.   |
| 11 | Learning outcomes    | Describe the system application software and operating system drivers to explain the source code of the existing device drivers to use the basics of programming language, competently use a set of tools for developing drivers. When programming, use the principles of parallel programming. Select and use appropriate language for programming of microprocessors and microcontrollers. Comparing devices microprocessors and microcontrollers. called types of sensors and smart sensors, to describe the basic elements of intelligent sensors that use neural networks, fundamentals of robotic systems. Demonstrate knowledge of intelligent systems in an automated system in agriculture, in industry, in the production. To make decisions in case of breakage devices and judiciously solve the problem; to plan actions for the use of new devices and the programming of these devices. Define the principles slaves in the neural network, in robotics. |

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|----|----------------------|---|
| 1  | Name of course       | Cyber security  |
| 2  | Code of course       | Kib 3222  |
| 3  | Cycle of course      | Base requirements(BS)   |
| 4  | Amount of credits    | 6   |
| 5  | Level of preparation | Undergraduate studies   |
| 6  | Department           | Computer Engineering and Software   |
| 7  | Year                 | 3   |
| 8  | Prerequisites        | Mathematical foundations in ICT, Physics, Algorithms and data structures  |
| 9  | Postrequisites       | Mesh shielding, Topics diploma and course works   |
| 10 | Course summary       | Cybersecurity : basic concepts and definitions. Network technologies and protocols: basic concepts and definitions. Functional safety: basic concepts and definitions. Cybersecurity in the " Internet of Things ". Cybersecurity for Smart City systems. Cybersecurity in the " Internet of Things " in the industry. Security systems design.   |
| 11 | Learning outcomes    | Select the programming language for computer hardware. Make programs for microprocessors, microcontrollers. To be able to program individual instruction blocks in microcontrollers and microprocessors, determine a relationship of the microcontroller / microprocessor with external devices in equipments APC. Check the protection of information in computer systems. Choose methods of information protection from outside intruders. Use programming encryption algorithms, to develop programs for encoding and decoding data. To be able to create anti-virus programs. |

|   |                 |                       |
|---|-----------------|-----------------------|
| 1 | Name of course  | Mesh shielding        |
| 2 | Code of course  | ME 3223               |
| 3 | Cycle of course | Base requirements(BS) |

|    |                      |   |
|----|----------------------|---|
| 4  | Amount of credits    | 6   |
| 5  | Level of preparation | Undergraduate studies   |
| 6  | Department           | Computer Engineering and Software   |
| 7  | Year                 | 3   |
| 8  | Prerequisites        | Mathematical foundations in ICT, Physics, Algorithms and data structures  |
| 9  | Postrequisites       | Topics diploma and course works   |
| 10 | Course summary       | "Classification of firewalls and Policy firewall'a. Different types of environments firewall'a. Example of packet filters in running the FreeBSD 6.0 65. Intrusion Detection Systems (the IDS). The deployment of IDS. The principles of the safe deployment of DNS services. DNS Transaction Security DNS Query / Response. Securing Web Servers. Security of Web Content. Authentication and Encryption Technologies. Implementing a secure network infrastructure for a web server "   |
| 11 | Learning outcomes    | Select the programming language for computer hardware. Make programs for microprocessors, microcontrollers. To be able to program individual instruction blocks in microcontrollers and microprocessors, determine a relationship of the microcontroller / microprocessor with external devices in equipments APC. Check the protection of information in computer systems. Choose methods of information protection from outside intruders. Use programming encryption algorithms, to develop programs for encoding and decoding data. To be able to create anti-virus programs. |

**MINISTRY OF AGRICULTURE OF THE REPUBLIC OF KAZAKHSTAN  
"NJSC "S. SEIFULLIN KAZAKH AGROTECHNICAL UNIVERSITY"**

Brief description of elective disciplines of the educational program

Animal feeding

|    |                      |  |
|----|----------------------|--|
| 1  | Name of course       | Java application development (part 1)  |
| 2  | Code of course       | RPJCh 3225   |
| 3  | Cycle of course      | Base requirements(BS)  |
| 4  | Amount of credits    | 7  |
| 5  | Level of preparation | Undergraduate studies  |
| 6  | Department           | Computer Engineering and Software  |
| 7  | Year                 | 3  |
| 8  | Prerequisites        | Programming in Java  |
| 9  | Postrequisites       | Driver programming for OS, Pattern recognition   |
| 10 | Course summary       | Classes. Inheritance. Encapsulation Creation of modules and independent exe-applications. Software tools for developing applications. Creating applications with GUI (applets and window applications). Creating applications for working with databases. Use of technology programming languages. Review of graphic libraries. Developing Webapplications.  |
| 11 | Learning outcomes    | PO3-Develop, describe and explain the algorithm for solving the problem, determine the structure of the problem: a linear, branched and cyclic, interpret the data structure: lists, arrays, sets, files, strings, etc. Explain to choose and use a "top down" programming and ". bottom-up "master practical skills of programming in a programming language, to show differences in the syntax of programming languages and their features, principles of programming, structure and types of programming, applying s expertise in application development; tabled in the difficult areas of application development, to show a complete picture of the problem PO 4 - to analyze the problem, identify solutions and to select efficient algorithms for the task. Allocate the input and output data. Understand the integrity of the developed software. Select tools and programming language for the effective implementation of the software. Develop (write program code to determine the design, verefitsirovat, test, etc.) complete the application database, Web portals, individual modules to them, to integrate the modules in the application. |

|    |                      |  |
|----|----------------------|--|
| 1  | Name of course       | Java application development (part 2)  |
| 2  | Code of course       | RPJCh 3229   |
| 3  | Cycle of course      | Base requirements(BS)  |
| 4  | Amount of credits    | 6  |
| 5  | Level of preparation | Undergraduate studies  |
| 6  | Department           | Computer Engineering and Software  |
| 7  | Year                 | 3  |
| 8  | Prerequisites        | Programming in Java  |
| 9  | Postrequisites       | Driver programming for OS, Pattern recognition   |
| 10 | Course summary       | Classes. Inheritance. Encapsulation Creation of modules and independent exe-applications. Software tools for developing applications. Creating applications with GUI (applets and window applications). Creating applications for working with databases. Use of technology programming languages. Review of graphic libraries. Developing Webapplications.  |
| 11 | Learning outcomes    | PO3-Develop, describe and explain the algorithm for solving the problem, determine the structure of the problem: a linear, branched and cyclic, interpret the data structure: lists, arrays, sets, files, strings, etc. Explain to choose and use a "top down" programming and ". bottom-up "master practical skills of programming in a programming language, to show differences in the syntax of programming languages and their features, principles of programming, structure and types of programming, applying s expertise in application development; tabled in the difficult areas of application development, to show a complete picture of the problem PO 4 - to analyze the problem, identify solutions and to select efficient algorithms for the task. Allocate the input and output data. Understand the integrity of the developed software. Select tools and programming language for the effective implementation of the software. Develop (write program code to determine the design, verify, test, etc.) complete the application database, Web portals, individual modules to them, to integrate the modules in the application. |

|    |                      |  |
|----|----------------------|--|
| 1  | Name of course       | Networking and System Administration   |
| 2  | Code of course       | STSA 3305  |
| 3  | Cycle of course      | Base requirements(BS)  |
| 4  | Amount of credits    | 5  |
| 5  | Level of preparation | Undergraduate studies  |
| 6  | Department           | Computer Engineering and Software  |
| 7  | Year                 | 3  |
| 8  | Prerequisites        | Operating systems and system programming   |
| 9  | Postrequisites       | Modern computer architecture Neural networks, Intelligent sensors  |
| 10 | Course summary       | The concept of computer network (IVS). Network classification. Ways and methods of switching. Multi-level approach in the development of networking tools. Open systems. Specification concepts. The principle of decomposition. Protocols and protocol stacks. Interfaces Open Systems Interconnection OSI Model. The structure of ITT. Analog and digital data transmission channels. The Internet. Network topology Network administration  |
| 11 | Learning outcomes    | Describe the concept of a computer network. Enumerate the layers of the OSI reference model and their purpose. Explain and to give specific examples of the principle construction of LAN, wireless data transmission operation of virtual network address in the stack TCP / IP protocol. Describe the computer system of physical objects ("things"), equipped with built-in technologies to interact with each other and the environment. Construct WLAN, a virtual network, a client server network. Configure the switch and router for networking. Perform network administration. To justify action on the network using IoT network technologies in the workplace, in industry, in agriculture. To choose and configure the device for constructing a specific network |

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|---|----------------|---------------------|
| 1 | Name of course | Intelligent sensors |
|---|----------------|---------------------|



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|----|----------------------|---|
| 2  | Code of course       | IS 4318   |
| 3  | Cycle of course      | Additional courses  |
| 4  | Amount of credits    | 6   |
| 5  | Level of preparation | Undergraduate studies   |
| 6  | Department           | Computer Engineering and Software   |
| 7  | Year                 | 4   |
| 8  | Prerequisites        | Mathematical foundations in ICT, Algorithms and data structures   |
| 9  | Postrequisites       | Topics diploma and course works   |
| 10 | Course summary       | From simple sensors to intelligent ones. From simple sensors to intelligent ones. Mechanical displacement sensors. The principles of the global orienteering system and GPS sensors. Vibration and chromatographic sensors. Physical principles of acoustic sensors. Some intelligent acoustic sensors. Intelligent Acoustic Sensors for Ultrasound. Element base of intelligent sensors.   |
| 11 | Learning outcomes    | Understanding the circuitry of electronic devices in the computer, choose the machine programming languages for programming electronic devices, describe the design and operation logic integrated devices in the computer chip to store the results of logical connections in chips, roughly calculate the result obtained, display circuitry devices (encoders, decoders, encoders, decoders , transistors) computer system. Define requirements for the designed integrated circuits, to argue their work. |

|   |                   |                         |
|---|-------------------|-------------------------|
| 1 | Name of course    | Design methods for FPGA |
| 2 | Code of course    | MPP 3311                |
| 3 | Cycle of course   | Additional courses      |
| 4 | Amount of credits | 5                       |

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|----|----------------------|---|
| 5  | Level of preparation | Undergraduate studies   |
| 6  | Department           | Computer Engineering and Software   |
| 7  | Year                 | 4   |
| 8  | Prerequisites        | Mathematical foundations in ICT, Algorithms and data structures   |
| 9  | Postrequisites       | IoT Technologies, Fundamentals of Robotic Systems, Driver Programming for OS  |
| 10 | Course summary       | Functional modeling of the designed device based on the PLIS. Structure and methods for preparing the test module of the project. Creating a test module of the project in text format and in the form of time diagrams. Stages of simulation of digital devices based on FPGA. Use VHDL language to describe the design of the device. Study of functional modeling technology   |
| 11 | Learning outcomes    | Understanding the circuitry of electronic devices in the computer, choose the machine programming languages for programming electronic devices, describe the design and operation logic integrated devices in the computer chip to store the results of logical connections in chips, roughly calculate the result obtained, display circuitry devices (encoders, decoders, encoders, decoders , transistors) computer system. Define requirements for the designed integrated circuits, to argue their work. |