CATALOG OF ELECTIVE DISCIPLINES

6B06 - Information and Communication Technologies
(Code and classification of the field of education)

6B061 - Information and communication technologies
(Code and classification of the direction of training)

0610
(Code in the International Standard Classification of Education)

B057 - Information technology
(Code and classification of the educational program group)

6B06106 - SMART systems and programming
(Code and name of the educational program)

bachelor
(Level of preparation)

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Chairman of the Academic Council I.Oralkanova

Programming in PHP

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline "Programming in PHP" is intended for students who want to master one of the most popular programming languages in web development - PHP. During the course, students deepen their knowledge of PHP programming and learn the principles of database development in combination with PHP to create dynamic web applications that interact with databases. They master the syntax of a language that allows them to develop scalable and flexible web applications.

Purpose of studying of the discipline
Preparing students to create dynamic web applications interacting with databases using PHP

Learning Outcomes
ON8 Develop web applications and intuitive user interfaces using various programming languages, technologies and frameworks

Learning outcomes by discipline
1) Master the basic principles and concepts of programming in PHP.
2) They will study the principles of database development and their integration with the PHP language.
3) Become capable of creating dynamic web applications that interact with databases.
4) Master the syntax of the PHP language, which allows you to develop scalable and flexible web applications.
5) Gain experience working with various frameworks and tools used in PHP development.

Prerequisites
Advanced WEB technologies

Postrequisites
Research project

Advanced programming in C#

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
In this course, students will deepen their knowledge in the field of programming C#. The course is aimed at developing advanced knowledge and skills necessary for the development of complex and large projects in C#. During the course, students will study advanced topics such as multithreading, working with databases, application architecture and testing. The acquired knowledge will allow students to create efficient, scalable software in C#.

Purpose of studying of the discipline
The purpose of the discipline "Programming in C#" is to form students with advanced knowledge and skills necessary for the development of complex and large projects in C#.

Learning Outcomes
ON4 Design, develop algorithms for solving various tasks and programs using the principles of object- oriented programming and functional programming

Learning outcomes by discipline
1)understand the basic concepts and principles related to the C# programming language
2)can apply their knowledge and understanding of the C# programming language to solve specific tasks
3)can use their knowledge, understanding and analytical skills to create new ideas and solutions in the field of advanced programming in C#

Prerequisites
Advanced WEB technologies

Postrequisites
Research project

Administration of web servers and hosting

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
This discipline introduces students to the basics of managing and maintaining web servers and hosting environments. In the course of studying this discipline, students learn about various types of web servers and study their functionality and capabilities. They study the principles of configuring and managing web servers, including setting up virtual hosts, managing SSL certificates, and routing traffic. They learn how to create, set up hosting accounts, manage domain names, set up databases and install web applications.

Purpose of studying of the discipline
The purpose of this discipline is to familiarize students with the basics of managing and maintaining web servers and hosting environments.

Learning Outcomes
ON5 Manage and administer network systems, including configuring and maintaining network equipment, configuring network security and solving problems in network systems.

Learning outcomes by discipline

1. Configure and manage web servers, including setting up virtual hosts, managing SSL certificates, and routing traffic.
2. Create and configure hosting accounts, manage domain names and configure databases.
3. Install and configure web applications to work on web servers.
4. Administer network resources and ensure their reliable operation.

Prerequisites
School course

Postrequisites
Computer network security

Computer networks

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
This discipline is designed to study the principles, protocols and architecture of computer networks. The course is aimed at developing students` deep understanding of network technologies and their application in the modern information society. During the training, students will learn how to configure and administer network equipment, diagnose and troubleshoot network connections. They will also get acquainted with protocols and standards used in computer networks, such as TCP/IP, Ethernet, Wi-Fi and others.

Purpose of studying of the discipline
The purpose of this discipline is to study the principles, protocols and architecture of computer networks

Learning Outcomes
ON5 Manage and administer network systems, including configuring and maintaining network equipment, configuring network security and solving problems in network systems.

Learning outcomes by discipline
1) memorize facts and understand the basic concepts of computer networks
2) can show their understanding of the basic concepts and principles of computer networks
3) can apply their knowledge and understanding of computer networks to solve specific tasks

Prerequisites
School course

Postrequisites
Computer network security

Applied information theory

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

Short description of discipline
"Applied Information Theory" is a discipline that studies the basics of transmitting, processing and storing information. Students study various methods of information encoding, data compression algorithms, data transmission protocols, signal processing and filtering, cryptography, coding theory, information systems and information security. This discipline allows students to master the tools and methods necessary for effective work with information in various fields of application.

Purpose of studying of the discipline
The purpose of this discipline is to study the basics of transmission, processing and storage of information

Learning Outcomes
ON3 Work with large amounts of data, including processing, storing and managing them

Learning outcomes by discipline
1)understand the basic concepts and principles related to computer systems and networks
2)can apply their knowledge and understanding of computer systems and networks to solve specific tasks
3)can use their knowledge, understanding and analytical skills to create new ideas and solutions in the field of computer systems and networks

Prerequisites
School course

Postrequisites
Signal analysis and processing

Scientific graphics in Python

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course builds the skills of creating scientific graphics using the Python programming language and its libraries. In the course of training, students study various types of graphs, methods of their construction, and also learn how to use libraries for data visualization. Getting skills in scientific graphics in Python will help students create effective visualizations for their scientific research, present the results of their work in an understandable and visual form.

Purpose of studying of the discipline
The purpose of the discipline "Scientific Graphics in Python" is to develop students` skills in creating scientific graphics using the Python

programming language and its libraries

Learning Outcomes

ON9 Design computer graphics using various tools and techniques to create unique visual compositions

Learning outcomes by discipline

1)understand the basic concepts and principles associated with using Python to create scientific graphics
2)can apply their knowledge and understanding of Python to create specific graphs
3)can use their knowledge, understanding and analytical skills to create new ideas and solutions in the field of scientific graphics in Python

Prerequisites

Python object-oriented programming

Postrequisites

Software quality testing and assurance Research project Advanced programming in Java, JSP and JOBS Machine learning

Basics of Java programming

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

This course will introduce students to the basics of programming in Java. The course is aimed at developing the basic knowledge and skills necessary to create simple Java applications. During the course, students will learn the basics of Java syntax, data structures, as well as gain experience in creating console applications and applying the basic language constructs. The knowledge gained will help students to begin development in the field of Java programming.

Purpose of studying of the discipline

The purpose of this discipline is to familiarize students with the basics of programming in Java and the formation of basic knowledge and skills necessary to create simple applications in this language.

Learning Outcomes

ON4 Design, develop algorithms for solving various tasks and programs using the principles of object- oriented programming and functional programming

Learning outcomes by discipline

1)understand the basic concepts and principles related to the Java programming language
2)can apply their knowledge and understanding of the Java programming language to solve specific tasks.
3)can develop a new class or method in Java that solves a specific task more efficiently

Prerequisites

Python object-oriented programming

Postrequisites

Software quality testing and assurance Research project Advanced programming in Java, JSP and JOBS Machine learning

Creating Windows applications based on Visual C#

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

This course forms the skills of creating Windows applications based on Visual C#. In the course of training, students study the creation of graphical interfaces, interaction with databases and application development using various technologies. Acquiring skills in creating Windows applications based on Visual C# will give students the opportunity to put them into practice and increase their chances in the labor market in the field of software development.

Purpose of studying of the discipline

The purpose of the discipline "Creating Windows applications based on Visual C#" is to form students` skills in developing Windows applications using the C# programming language and the Visual Studio development environment.

Learning Outcomes

ON4 Design, develop algorithms for solving various tasks and programs using the principles of object- oriented programming and functional programming

Learning outcomes by discipline

1)understand the basic concepts and principles associated with creating Windows applications based on Visual C#
2)can apply their knowledge and understanding of Visual C# to create specific applications
3)can use their knowledge, understanding and analytical skills to create new ideas and solutions in the field of creating Windows applications based on Visual C#

Prerequisites

Python object-oriented programming Advanced programming in C#

Postrequisites

Software quality testing and assurance Research project Advanced programming in Java, JSP and JOBS Machine learning

Project development in an Agile environment

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline "Project Development in an Agile environment" is aimed at developing software development skills in flexible methodologies, including Scrum, Kanban and others. The course covers all aspects of the development lifecycle, from planning and evaluation to product testing and delivery. The training includes practical tasks, including teamwork and the use of project management tools.
Purpose of studying of the discipline
The purpose of the discipline "Project Development in an Agile environment" is to form the skills and knowledge of students in software development in flexible methodologies such as Scrum, Kanban and others.
Learning Outcomes
ON10 Manage the software lifecycle, including planning, development, testing and implementation.
ON11 Conduct a research project, including the formulation of a task, data collection and analysis, application of statistical methods and presentation of research results
Learning outcomes by discipline
1)can describe Agile methodologies and their application in various projects
2)apply Agile methodologies when developing projects in a real environment
3)analyze project development processes using Agile methodology
4)create an Agile project in accordance with customer requirements and project specifications
Prerequisites
Basic and profile disciplines of the EP
Postrequisites
Own mobile development Research project

Project management

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline "Project Management" is aimed at the formation of knowledge and practical skills of project management in the field of web and mobile development. Students will learn the basic methods and tools of project planning, control and management, learn how to assess risks and communicate effectively with team members and customers. The course will also allow students to develop the skills of leadership and coordination of team work and achieving project goals in accordance with business requirements.
Purpose of studying of the discipline
The purpose of this discipline "Project Management" is to form students` knowledge and practical skills of project management in the field of web and mobile development.
Learning Outcomes
ON10 Manage the software lifecycle, including planning, development, testing and implementation.
ON11 Conduct a research project, including the formulation of a task, data collection and analysis, application of statistical methods and presentation of research results
ON12 To present the results of the work in front of the team and clients, demonstrating professionalism and knowledge of the subject area
Learning outcomes by discipline
1)describe the project lifecycle, assess risks, create a project plan and form a team
2)make a work plan, identify risks, make decisions and organize teamwork
3)adapt to changes, manage resources and communications, and create reports and documentation
4)analyze and evaluate the implementation of the project in accordance with the tasks set
Prerequisites
Basic and profile disciplines of the EP
Postrequisites
Own mobile development Research project

Managing the software development process

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course is also aimed at developing practical skills in planning and managing the software development process, including controlling deadlines, budget and product quality. Students will learn basic project management techniques such as Waterfall, Agile and Scrum, as well as learn how to work with project tools and task management systems. The course also includes analysis, optimization of the development process adapted to the specific needs and features of the project.
Purpose of studying of the discipline
The purpose of the discipline "Software Development Process Management" is to form practical skills and knowledge of students in planning and managing the software development process, developing their skills to control deadlines, budget and product quality, as well as effectively manage the project.
Learning Outcomes
ON10 Manage the software lifecycle, including planning, development, testing and implementation.
ON11 Conduct a research project, including the formulation of a task, data collection and analysis, application of statistical methods and presentation of research results
Learning outcomes by discipline

1) gain theoretical knowledge about the software development process, project management methods and process optimization.
2)have an understanding of methods and techniques for managing the software development process
3)apply the acquired knowledge and understanding in practice, using tools and methods for managing the development process
4)analyze and evaluate the effectiveness of the software development process
5)are able to create and develop management plans for the software development process based on the acquired knowledge and methods

Prerequisites

Basic and profile disciplines of the EP

Postrequisites

Own mobile development Research project

Cloud technologies

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

This discipline is the study of modern approaches and methods of using cloud computing and services. Students gain fundamental knowledge about the concepts, architecture and functionality of cloud environments, encryption methods, authentication and authorization mechanisms, as well as measures to ensure data privacy in the cloud environment. They deepen their knowledge of various types of cloud models, such as public, private and hybrid clouds.

Purpose of studying of the discipline

The purpose of this discipline is for students to master modern approaches and methods of using cloud computing and services

Learning Outcomes

ON5 Manage and administer network systems, including configuring and maintaining network equipment, configuring network security and solving problems in network systems.

Learning outcomes by discipline

1) Learn the basic concepts and methods of cloud computing.
2) Apply modern approaches and methods of using cloud services.
3) They will have knowledge of authentication and authorization mechanisms in the cloud.
4) Are able to analyze and select suitable cloud models for various tasks.
5) Develop skills for working with cloud services and tools.

Prerequisites

Computer networks

Postrequisites

Research project

Basics of operating systems

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

The purpose of this course is to familiarize students with the basic principles and functions of operating systems, as well as their role in the software development process. The course is aimed at developing skills to work with operating systems, configuring the development environment, administration and diagnostics of system errors. Students will learn how to use the command line, work with the file system, install and configure software

Purpose of studying of the discipline

The purpose of this discipline is to familiarize students with the basic principles and functions of operating systems, as well as to develop their skills to work with operating systems, configure the development environment, administer the system and diagnose system errors.

Learning Outcomes

ON6 Install operating systems on computers and servers, as well as configure them in accordance with the requirements and needs of users

Learning outcomes by discipline

1)understand the concepts and principles of operating systems, including process, memory, file system and network management
2)can explain how operating systems manage computer resources and how they relate to different types of applications.
3)can install and configure the operating system, as well as use tools to manage processes, file system and network.
4)they can analyze problems related to the operation of operating systems and find ways to solve them.
5)can evaluate the effectiveness of various operating systems and choose the most suitable for a particular project.

Prerequisites

Computer networks

Postrequisites

Research project

Network operating systems

Discipline cycle	Basic disciplines
Course	2
Credits count	5

Knowledge control form	Examination

Short description of discipline
This course builds students` knowledge and skills in the field of network operating systems, their device, functioning and administration. The course covers topics related to network protocols, hardware and software, network security and protection. As part of the course, students will also have the opportunity to practically apply their knowledge on the example of configuring and administering network operating systems.

Purpose of studying of the discipline
The purpose of this discipline is to form students` knowledge and skills in the field of network operating systems

Learning Outcomes
ON6 Install operating systems on computers and servers, as well as configure them in accordance with the requirements and needs of users

Learning outcomes by discipline
1)they can explain how data is exchanged in network operating systems, as well as what protocols are used
2)can create and configure network operating systems for various use cases.
3)can analyze the problems of network operating systems and offer solutions to eliminate them
4)can evaluate the efficiency of using network operating systems in various situations.
5)can create new configurations of network operating systems for various use cases.

Prerequisites
Computer networks

Postrequisites
Research project

Client-server applications using databases

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course introduces students to the principles of developing client-server applications based on the use of databases. The course covers such topics as application architecture, client and server technologies, SQL, data processing on the client and server side, as well as methods of protecting applications from external attacks. As a result of the training, students will be able to create client-server applications using databases and effectively manage them within projects.

Purpose of studying of the discipline
The purpose of this discipline is to familiarize students with the basic principles of developing client-server applications that are based on the use of databases.

Learning Outcomes
ON7 Design and develop databases, including choosing a suitable data model, creating tables, defining relationships between tables, constraints and indexes

Learning outcomes by discipline
1) know the basic concepts of client-server applications, the principles of working with databases and modern development technologies
2) understand the ways of organizing the interaction between the client and the server, the application development process and methods of working with databases.
3)evaluate the quality and performance of client-server applications
4)analyze the problems that arise when working with databases
5)evaluate the effectiveness of client-server applications and choose the best technologies and methods for solving specific tasks.

Prerequisites
MySQL Database Management Systems

Postrequisites
Designing WEB applications

Internet technologies

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course builds students` knowledge and skills of working with basic Internet technologies such as HTML, CSS, JavaScript, PHP and basic principles of web development. The course covers topics related to the design and development of websites, the creation of dynamic user interfaces, adaptive layout and the use of modern tools and technologies. As a result of the training, students will be able to create effective and interactive websites using modern Internet technologies.

Purpose of studying of the discipline
Formation of students` knowledge and skills of working with basic Internet technologies, such as HTML, CSS, JavaScript, PHP, as well as basic principles of web development.

Learning Outcomes
ON5 Manage and administer network systems, including configuring and maintaining network equipment, configuring network security and solving problems in network systems.

Learning outcomes by discipline
1) understand the basic principles of the functioning of the Internet and its infrastructure
2)evaluate and choose the best methods of Internet access
3)create and publish web content using HTML and CSS markup languages.

4)develop and deploy web applications on servers using modern web frameworks and tools

Prerequisites

Computer networks

Postrequisites

Cloud technologies and web applications

Multilevel WEB applications and Internet technologies

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

This course builds students` knowledge and skills in developing multi-level web applications, as well as understanding the basic principles of Internet technologies. The course covers topics related to the architecture of multi-level web applications, client-server interaction, working with databases, as well as web application security. As a result of the training, students will be able to develop multi-level web applications, including the design and implementation of the frontend, backend, the use of modern web frameworks, tools, as well as to ensure the security of the created applications.

Purpose of studying of the discipline

The purpose of this discipline is to form students` knowledge and skills of working with basic Internet technologies, such as HTML, CSS, JavaScript, PHP, as well as the basic principles of web development.

Learning Outcomes

ON8 Develop web applications and intuitive user interfaces using various programming languages, technologies and frameworks

Learning outcomes by discipline

1) they will describe the architecture of multi-level web applications and the principles of Internet technologies.
2) will develop multi-level web applications using modern web frameworks and tools.
3)will evaluate and apply client-server interaction in multi-level web applications.

Prerequisites

Advanced WEB technologies

Postrequisites

Designing WEB applications

Development and deployment of WEB applications

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

The course is aimed at developing students` knowledge and skills in the field of web application development and deployment. The course examines the architecture of web applications, working with databases, creating and configuring servers, using client libraries and frameworks, testing and deploying applications on the server. The training will allow students to develop effective web applications for various tasks, including the design and implementation of the frontend and backend, the use of modern web frameworks and tools.

Purpose of studying of the discipline

The purpose of the discipline "Development and deployment of web applications" is to form students` knowledge and skills in the field of development and deployment of web applications.

Learning Outcomes

ON8 Develop web applications and intuitive user interfaces using various programming languages, technologies and frameworks

Learning outcomes by discipline

1) understand the basic concepts and technologies of WEB development.
2)can design and create WEB applications using modern frameworks and tools.
3)can analyze and improve the performance of WEB applications
4) are able to work with databases and use them in WEB applications

Prerequisites

Advanced WEB technologies

Postrequisites

Designing WEB applications Designing Web Application design

Development of multithreaded and parallel applications

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

This discipline introduces students to the concepts and techniques of developing programs that can be executed in parallel and use multiple threads to efficiently use processor resources and improve performance.In the course of studying this discipline, students will learn about the principles of parallel programming and multithreading. They learn how to create and manage execution threads, synchronize access to shared resources, avoid race conditions, and ensure security when working with parallel processes.

Purpose of studying of the discipline

The purpose of this discipline is to familiarize students with the concepts and techniques of developing programs that can run in parallel and use multiple threads to efficiently use processor resources and improve performance.

Learning Outcomes
ON4 Design, develop algorithms for solving various tasks and programs using the principles of object- oriented programming and functional programming
Learning outcomes by discipline
1) Master the concepts and principles of parallel programming, as well as multithreading.
2) Learn how to create and manage execution threads, including creating, starting, suspending, and terminating threads.
3) Acquire the skills of synchronizing access to shared resources when working with multiple threads, using the mechanisms of semaphores, mutexes, conditional variables and other means.
4) They will study techniques for optimizing the performance of parallel programs, including parallelization of tasks, the use of thread pools and load balancing.
Prerequisites
Advanced WEB technologies Mobile Application Development (Android)
Postrequisites
Cloud technologies and web applications

Development using Vue.js

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course forms students` knowledge and practical skills in developing web applications using the framework Vue.js . The course covers topics such as building components, routing, working with APIs, using Vuex for state management, as well as developing complex web applications. As a result of the training, students will be able to develop efficient and scalable web applications using Vue.js using modern tools and practices.
Purpose of studying of the discipline
The purpose of this discipline is to form students` knowledge and practical skills in developing web applications using a framework Vue.js
Learning Outcomes
ON8 Develop web applications and intuitive user interfaces using various programming languages, technologies and frameworks
Learning outcomes by discipline
1)will be able to explain the concepts and terminology of Vue.js, as well as the principles of its operation
2) will be able to create complex applications using Vue.js
3)will be able to analyze problems in applications created using Vue.js, and offer solutions to improve them.
4)will create innovative applications using Vue.js, applying their knowledge and skills to solve complex problems.
Prerequisites
Advanced WEB technologies Mobile Application Development (Android)
Postrequisites
Cloud technologies and web applications

JavaScript Frontend development using

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
This discipline introduces students to the basics of developing a user interface and web applications using the JavaScript programming language.
Students also master the skills of using modern frameworks and libraries to create scalable and modular web applications. They learn how to create components, manage application state, route pages, and interact with the server API. They learn how to develop a user interface, interact with the server using modern frontend development tools and technologies.
Purpose of studying of the discipline
The purpose of this discipline is to introduce students to the basics of developing a user interface and web applications using the JavaScript programming language
Learning Outcomes
ON8 Develop web applications and intuitive user interfaces using various programming languages, technologies and frameworks
Learning outcomes by discipline
1) Master the basics of user interface (UI) development using the JavaScript programming language.
2) Deepen their skills in creating web applications, including working with modern frameworks and libraries.
3) Master the methods of developing scalable and modular web applications that provide a user-friendly experience.
4) Become capable of creating and managing user interface components, including event handling and changing the state of the application.
5) Learn the methods of page routing and interaction with the server API, providing dynamic and modern functionality of web applications.
6) Develop skills in working with modern frontend development tools and technologies, such as development environments, version control systems and debuggers.
7) Gain an understanding of the principles of designing the user interface and improving its user experience.
Prerequisites
Advanced WEB technologies Mobile Application Development (Android)
Postrequisites

Cloud technologies and web applications

Optimization Methods

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline "Optimization Methods" teaches students effective strategies for finding optimal solutions to various problems. The course studies various methods, such as gradient descent, linear and nonlinear programming methods, evolutionary algorithms, and others. Students will gain practical skills in developing and implementing optimization models, as well as learn how to use specialized software tools for analyzing and solving optimization problems.

Purpose of studying of the discipline
The purpose of the course "Optimization Methods" is to teach students effective strategies for finding optimal solutions in various tasks.

Learning Outcomes
ON3 Work with large amounts of data, including processing, storing and managing them

Learning outcomes by discipline
1) Apply effective strategies for finding optimal solutions in various tasks.
2) Design and implement linear and nonlinear programming models.
3) Develop optimization models for solving real problems and tasks.
4) Analyze and interpret optimization results for decision-making.
5) Use specialized software tools to analyze and solve optimization problems.
6) Develop strategies for global and local optimization depending on the task.

Prerequisites
Basic and profile disciplines of the EP

Postrequisites
Final examination

Mobile UI/UX design

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
This discipline is devoted to the study of the user interface design process and user experience for mobile applications. It combines design principles, technical aspects of mobile interface development, in order to create user-friendly and attractive user interfaces. Students studying the discipline "Mobile UI/UX Design" will gain practical skills in creating effective and attractive mobile interfaces, as well as an understanding of the importance of user experience for the success of mobile applications.

Purpose of studying of the discipline
The purpose of the course "Mobile UI/UX Design" is to study the process of designing a user interface (UI) and user experience (UX) for mobile applications.

Learning Outcomes
ON2 Design and develop a user interface for mobile applications, taking into account the features of mobile devices and their interaction with the user

Learning outcomes by discipline
1) Design user-friendly and attractive user interfaces for mobile applications.
2) Combine design principles and technical aspects of development when designing mobile interfaces.
3) Create practical and effective layouts of mobile interfaces.
4) Test and analyze the user experience using prototypes and testing with the user.
5) Design mobile interfaces taking into account the possibility of expanding and updating functionality.

Prerequisites
Basic and profile disciplines of the EP

Postrequisites
Final examination

Software quality testing and assurance

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course covers testing methods and tools, including functional and non-functional testing, test automation, security testing, and defect management and reporting techniques. The course is aimed at developing students` skills in developing and implementing test scenarios, as well as ensuring the quality of software. As a result of the training, students can apply various methods and tools for testing and ensuring the quality of software in real projects.

Purpose of studying of the discipline
The purpose of the course "Software Testing and Quality Assurance" is to develop students` skills and knowledge in the field of software testing, including functional and non-functional testing, test automation, security testing, defect management and reporting.

Learning Outcomes

ON4 Design, develop algorithms for solving various tasks and programs using the principles of object- oriented programming and functional programming
ON10 Manage the software lifecycle, including planning, development, testing and implementation.

Learning outcomes by discipline

1) Develop and implement test scenarios.
2) Automate testing.
3) Test non-functional aspects of the software.
4) Generate reports on test results.
5) Ensure the quality of the software.

Prerequisites

Basic and profile disciplines of the EP

Postrequisites

Final examination

Big Data Visualization

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline "Big Data Visualization" introduces students to the methods and techniques of visualization of complex and voluminous data. It teaches the basics of data visualization, including various types of graphs and charts. Students also study ways of processing and preprocessing large amounts of data, as well as the development of effective visualization algorithms. In addition, the discipline includes the study of visualization of time series, geographical data and interactive data visualization.

Purpose of studying of the discipline

The purpose of the course "Big Data Visualization" is to familiarize students with the methods and techniques of visualization of complex and voluminous data.

Learning Outcomes

ON9 Design computer graphics using various tools and techniques to create unique visual compositions

Learning outcomes by discipline

1. Apply different types of graphs and charts to visualize data.
2. Process and recycle large amounts of data.
3. Develop effective data visualization algorithms.
4. Create interactive data visualizations.
5. Analyze and interpret data visualizations.
6. Develop user interfaces for interactive data visualization.

Prerequisites

Cross-platform mobile development

Postrequisites

Final examination

Development of mobile applications for the Internet of Things (IoT)

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

This discipline prepares students to create high-quality applications for managing IoT devices. Students study the basic principles of IoT, communication protocols, technologies for mobile applications, including planning, design, testing and deployment. They learn to use frameworks, tools such as Android Studio, Xcode, Kotlin and Swift to create applications connected to IoT devices via Bluetooth, Wi-Fi and Zigbee protocols.

Purpose of studying of the discipline

The purpose of the course "Development of mobile applications for the Internet of Things (IoT)" is to prepare students to create high-quality applications for managing Internet of Things (IoT) devices.

Learning Outcomes

ON2 Design and develop a user interface for mobile applications, taking into account the features of mobile devices and their interaction with the user
ON10 Manage the software lifecycle, including planning, development, testing and implementation.

Learning outcomes by discipline

1) Create high-quality applications for managing iOS devices.
2) Define communication protocols for interacting with iOS devices.
3) Design mobile applications for managing iOS devices.
4) Test mobile applications for managing iOS devices.
5) Deploy applications to connect to IoT devices.
6) Integrate mobile apps with cloud services to manage iOS devices.

Prerequisites

Cross-platform mobile development

Postrequisites

Final examination

Own mobile development

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
This discipline prepares students to create high-quality mobile applications and trains them to the skills necessary to work in the mobile development industry. Within the framework of this discipline, students study the process of developing mobile applications, including planning, design, testing, deployment. They will learn how to create attractive, intuitive user interfaces, how to implement application functionality and how to test them on various devices and operating systems.

Purpose of studying of the discipline
The purpose of the course "Own Mobile Development" is to prepare students to create high-quality mobile applications and master the skills necessary to work in the mobile development industry, develop students` practical skills related to the mobile application development process, from planning and design to testing and deployment.

Learning Outcomes
ON2 Design and develop a user interface for mobile applications, taking into account the features of mobile devices and their interaction with the user
ON10 Manage the software lifecycle, including planning, development, testing and implementation.

Learning outcomes by discipline
1) Create high-quality mobile applications.
2) Plan and organize the mobile application development process.
3) Design user interfaces for mobile applications.
4) Implement the functionality of mobile applications.
5) Test mobile applications on various devices and operating systems.

Prerequisites
Cross-platform mobile development

Postrequisites
Final examination

Signal analysis and processing

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course is designed to study methods and techniques of analysis and processing of various types of signals. During the training, students will learn the basics of working with signals, study methods of signal conversion and filtering, as well as methods for detecting and extracting features. It helps students develop skills in working with signals, analyze their characteristics and apply appropriate processing methods to extract information and solve practical problems.

Purpose of studying of the discipline
The purpose of this discipline is to study methods and techniques of analysis and processing of various types of signals.

Learning Outcomes
ON3 Work with large amounts of data, including processing, storing and managing them

Learning outcomes by discipline
1) Learn the basics of working with signals, including their nature, characteristics and types.
2) Apply signal conversion methods such as Fourier transform, wavelet transform and discrete Fourier transform to analyze the frequency and time characteristics of signals.
3) Apply signal filtering techniques, including low-frequency, high-frequency and bandpass filters, to remove noise and improve signal quality.
4) Analyze the characteristics of signals, such as amplitude, frequency, phase and duration, in order to understand their content and properties.
5) Develop algorithms and programs for signal processing and analysis using specialized software tools and libraries.
6) Evaluate the effectiveness of signal analysis and processing methods by conducting a comparative analysis of various approaches and applying quality criteria.

Prerequisites
Applied information theory

Postrequisites
Final examination

Optimization and modeling of smart systems

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The course "Optimization and modeling of smart systems" is a study of methods and techniques of optimization and modeling in order to improve the efficiency of smart systems. During the training, students master the skills of building mathematical models, applying optimization methods and analyzing the effectiveness of smart systems.

Purpose of studying of the discipline

"The purpose of the course "Optimization and modeling of smart systems" is to teach students methods and techniques of optimization and modeling to improve the efficiency of smart systems and develop skills in building mathematical models and applying optimization methods to optimize and improve the functioning of smart systems."

Learning Outcomes

ON9 Design computer graphics using various tools and techniques to create unique visual compositions

Learning outcomes by discipline

1) Build mathematical models.
2) Apply optimization methods.
3) Optimize the operation of smart systems.
4) Optimize decision-making processes in smart systems.
5) Simulate the interaction of smart system components.
6) Design and optimize algorithms for smart systems.
7) Research and propose improvements for smart systems.
8) Develop models for predicting the behavior of smart systems.

Prerequisites

Computer networks

Postrequisites

Final examination

Advanced programming in Java, JSP and JOBS

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline is a continuation of the study of the Java programming language and its application in web development. The purpose of the discipline is to train specialists who will be able to develop complex Java web applications using JSP (JavaServer Pages) and JOBS (Java Object Binding Service). Students will gain knowledge on how to use these technologies to create dynamic web pages that work with databases and other web services.

Purpose of studying of the discipline

The purpose of the course "Advanced Programming in Java, JSP and JOBS" is to prepare students for the development of complex web applications in the Java programming language using JSP (JavaServer Pages) and JOBS (Java Object Binding Service) technologies.

Learning Outcomes

ON4 Design, develop algorithms for solving various tasks and programs using the principles of object- oriented programming and functional programming

Learning outcomes by discipline

1) Develop complex web applications in Java.
2) Use JSP (JavaServer Pages) to create dynamic web pages.
3) Apply JOBS (Java Object Binding Service) to develop web applications in Java.
4) Work with databases in Java web applications.
5) Program the functionality of web pages using Java.
6) Test and debug web applications in Java.

Prerequisites

Basics of Java programming

Postrequisites

Final examination

Cloud technologies and web applications

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline "Cloud technologies and Web applications" covers cloud computing technologies and their application in the creation of web applications. Within this discipline, students study the principles of cloud platforms such as Amazon Web Services (AWS) and Microsoft Azure, and practical skills in developing web applications using these platforms.. Students learn how to use cloud platforms to deploy and scale web applications, as well as to manage data and resources.

Purpose of studying of the discipline

The purpose of this discipline is to form students` knowledge and skills on the use of cloud technologies for the development and deployment of web applications.

Learning Outcomes

ON8 Develop web applications and intuitive user interfaces using various programming languages, technologies and frameworks

Learning outcomes by discipline

1) Learn how cloud platforms work, including Amazon Web Services (AWS) and Microsoft Azure.
2) Develop web applications using cloud platforms such as AWS and Azure.
3) Analyze and evaluate the advantages and limitations of using cloud technologies and platforms in the context of web application development.
4) Use cloud services to develop and integrate various components of web applications, such as databases, caches, file storage and other services.

Prerequisites

Blender computer graphics and visual effects Development using Vue.js

Postrequisites

Final examination

Interface and user interaction

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

"Interface and User Interaction" is a discipline that studies the design, development and evaluation of user interfaces for software and other information systems. It focuses on creating a user-friendly, efficient and enjoyable user experience. During the course of studying this discipline, students will learn about the principles of user interface design, including aspects of visual design, usability, user interaction and ergonomics.

Purpose of studying of the discipline

The purpose of this discipline is to study the design, development and evaluation of the user interface for software and information systems.

Learning Outcomes

ON4 Design, develop algorithms for solving various tasks and programs using the principles of object- oriented programming and functional programming

Learning outcomes by discipline

1) Design the user interface, taking into account the principles of design, usability and ergonomics.
2) Develop a user interface for software and information systems using appropriate tools and technologies.
3) Evaluate the quality of the user interface and conduct usability testing by analyzing user reviews and data.
4) Interact effectively with the development team and other stakeholders to reach agreement on user interface issues.
5) Present your ideas and solutions for user interface design in front of a public audience or a project team.

Prerequisites

Blender computer graphics and visual effects Development using Vue.js

Postrequisites

Final examination

Designing Web Application design

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

Within the framework of this discipline, students are engaged in practical design, development of web applications with a design bias. It provides students with the opportunity to apply their knowledge and skills in creating aesthetically attractive and user- friendly web interfaces. Students are introduced to tools and technologies for the design of web interfaces, such as graphic editors, prototyping, visual style editors. They study the principles of composition, color, typography, iconography and other aspects of design.

Purpose of studying of the discipline

The purpose of this discipline is to form students` knowledge and skills for designing and developing aesthetically attractive and user-friendly web interfaces.

Learning Outcomes

ON10 Manage the software lifecycle, including planning, development, testing and implementation.
ON11 Conduct a research project, including the formulation of a task, data collection and analysis, application of statistical methods and presentation of research results

Learning outcomes by discipline

1) Design aesthetically appealing web interfaces, taking into account the principles of composition, color, typography and iconography.
2) Develop web applications with a design bias using appropriate tools and technologies, such as graphic editors, prototyping and visual style editors.
3) Apply knowledge and skills in creating user-friendly web interfaces, providing a positive user experience.
4) Research the requirements and needs of users in order to adapt the design of the web interface to them.

Prerequisites

Blender computer graphics and visual effects Development using Vue.js

Postrequisites

Final examination

Computer vision and image processing

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline is the study of methods and technologies used for processing and analyzing images using computers. The discipline is aimed at studying methods and algorithms of image processing used in various fields, such as medicine, manufacturing, transport, robotics. In addition, within the framework of this discipline, students learn to use various tools and technologies, such as OpenCV, MATLAB, Python, to create and optimize image processing algorithms.

Purpose of studying of the discipline
The purpose of this discipline is to teach students methods and technologies of image processing using computers
Learning Outcomes
ON9 Design computer graphics using various tools and techniques to create unique visual compositions
Learning outcomes by discipline
1) Apply image processing methods and algorithms to improve the quality and visual characteristics of images.
2) Develop and optimize image processing algorithms, taking into account specific requirements and application goals in various fields.
3) Analyze images and extract features to solve problems of recognition, classification or segmentation of objects in images.
4) Apply computer vision methods for automatic object recognition, defect detection, motion analysis and other tasks.
5) Evaluate the results of image processing, conduct qualitative and quantitative analysis and draw conclusions based on the data obtained.
Prerequisites
Basic and profile disciplines of the EP
Postrequisites
Final examination

Machine learning

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
This discipline is the study of technologies and methods used by computers to automatically improve and optimize their algorithms and functions based on large amounts of data and feedback. The discipline is aimed at the study and practical application of machine learning methods, algorithms and technologies for the purpose of data analysis and processing, as well as solving various tasks in various fields, including computer vision.
Purpose of studying of the discipline
The purpose of this discipline is for students to study machine learning technologies and methods, as well as optimization of algorithms and functions based on data and feedback.
Learning Outcomes
ON10 Manage the software lifecycle, including planning, development, testing and implementation.
ON11 Conduct a research project, including the formulation of a task, data collection and analysis, application of statistical methods and presentation of research results
Learning outcomes by discipline
1) Optimize algorithms and functions using optimization methods such as gradient descent, genetic algorithms, optimization using swarm intelligence and others.
2) Apply techniques and methods for processing large amounts of data, including data preprocessing, feature selection and dimensionality reduction.
3) Create machine learning models, select and configure suitable algorithms and model architectures for solving specific tasks.
4) Analyze and interpret the results of machine learning models, evaluate their accuracy, efficiency and stability.
5) Apply feedback and reinforcement learning methods to optimize and improve algorithms based on the data and experience.
6) Design and develop machine learning systems, including their integration into the real environment and interaction with other components.
Prerequisites
Basic and profile disciplines of the EP
Postrequisites
Final examination

Statistical Data Analysis

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline "Statistical Data Analysis" teaches students the methods of statistical data analysis that allow them to effectively process, interpret, and visualize data. They also learn to use various tools and technologies, such as Python, R, SAS and others, for data analysis. In general, the discipline has a great practical application in various fields where the analysis and interpretation of large amounts of data is required.
Purpose of studying of the discipline
The purpose of this discipline is to teach students the methods and techniques of statistical data analysis.
Learning Outcomes
ON3 Work with large amounts of data, including processing, storing and managing them
Learning outcomes by discipline
1) Process data using various methods of statistical analysis.
2) Interpret the results obtained and draw conclusions based on statistical data analysis.
3) Apply various statistical methods to test hypotheses and conduct statistical tests.
4) Visualize data using graphs, charts and other data visualization tools.
5) Design and conduct experiments, collect data and analyze their results using statistical methods.
Prerequisites
Basic and profile disciplines of the EP

Postrequisites
Final examination

Pre-graduate practice

Discipline cycle	Profiling discipline
Course	3
Credits count	15
Knowledge control form	Total mark on practice

Short description of discipline
During the internship, students work in companies or organizations engaged in web and mobile development, where they gain valuable experience and learn to work in a professional environment. They can participate in the development of websites, mobile applications or other projects related to web and mobile development.
Students perform real tasks, work in a team with other developers and receive feedback from experienced specialists. They can apply their knowledge of web technologies, programming languages, databases and other tools to create functional and effective web and mobile solutions.
Purpose of studying of the discipline
The purpose of the pre-graduate internship is to provide students with the opportunity to gain practical experience in the professional environment of web and mobile development, apply and consolidate the knowledge and skills acquired during training, and prepare them for future professional activities.
Learning Outcomes
ON12 To present the results of the work in front of the team and clients, demonstrating professionalism and knowledge of the subject area
Learning outcomes by discipline
1) Perform real tasks in the field of web and mobile development.
2) Gain valuable work experience in a professional environment.
3) Actively participate in the development of websites, mobile applications and other projects related to web and mobile development.
4) Collaborate with other developers, interact effectively in a team.
5) Adapt to the working conditions and requirements of the development industry.
6) Show responsibility, think creatively and strive to achieve high quality web and mobile solutions.
Prerequisites
Production practice 2
Postrequisites
Final examination

Production practice 3

Discipline cycle	Profiling discipline
Course	3
Credits count	15
Knowledge control form	Total mark on practice

Short description of discipline
Industrial Practice 3 is an internship that provides students with the opportunity to gain real work experience in the industry.The main goal of the internship is to provide students with the opportunity to participate in real-world mobile and web application development projects, interact with the development team, and gain experience with tools and technologies used in the industry. Upon completion of the internship, students should have practical experience working with tools and technologies used in programming.
Purpose of studying of the discipline
The purpose of this internship is to enable students to participate in real-world projects and interact with the development team to understand and apply the processes and methodologies used in the programming industry.
Learning Outcomes
ON12 To present the results of the work in front of the team and clients, demonstrating professionalism and knowledge of the subject area
Learning outcomes by discipline
1) Participate in real mobile and web application development projects.
2) Interact with the development team.
3) Gain experience working with tools and technologies used in the programming industry.
Prerequisites
Production practice 2
Postrequisites
Final examination