
Faculty of Computer Technologies and Cybersecurity
Department of Computer Engineering

APPROVED BY
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“14” 03 2023

6B06107

Cyberphysical Systems

CATALOGUE OF ELECTIVE DISCIPLINES


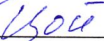
2023 entry year

2023

The catalogue of elective disciplines for the specialty/AP 6B06107 Cyberphysical Systems is developed on the basis of the working curriculum of the specialty/AP.

The catalogue of elective disciplines was discussed at a meeting of the "CE" department minutes No. 8 from "10" 02 2023

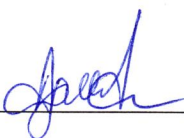
Acting Head of Dep  Chinibayeva T.T.

CED compiler  Chinibayeva T.T.
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The catalogue of elective disciplines was approved at a meeting of the Academic Council of JSC IITU

minutes No. 4 from "19" 03 2023

Head of the Department
of educational and methodological activities



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1 TERMS AND ABBREVIATIONS

1.1 Academic program is a single set of basic characteristics of education, including goals, results and content of training, the organization of educational process, ways and methods for their implementation and criteria for assessing learning outcomes. The content of academic program of higher education consists of three cycles of disciplines - general education disciplines (hereinafter - GED), basic disciplines (hereinafter - BD) and core disciplines (hereinafter - CD). The cycle of GED includes disciplines of the compulsory component (hereinafter - CC), the university component (hereinafter - UC) and (or) the component of choice (hereinafter - COC). BD and CD include disciplines of UC and COC.

1.2 Catalogue of elective disciplines (CED) is a systematic annotated list of all COC disciplines, for the entire training period, containing a brief description indicating the purpose of study, a summary of main sections and expected learning outcomes. CED reflects the prerequisites and postrequisites of each academic discipline. It should provide the students with the possibility of an alternative choice of elective disciplines for the formation of an individual educational trajectory.

On the basis of academic program and CED, the students develop individual curricula with the help of advisers.

1.3 Individual curriculum (IC) is a curriculum formed by the students independently with the help of an adviser for each academic year on the basis of the academic program, the catalogue of elective disciplines or modules;

IC defines an individual educational trajectory of each student separately. It includes disciplines and types of educational activities (internship, experimental research, forms of final certification) of the compulsory component (CC), the university component (UC) and the component of choice (COC).

1.4 Advisor is a teacher who performs the functions of an academic mentor of a student (according to the appropriate academic program), and assists in choosing a learning path (creating an individual curriculum) and mastering the academic program during the training period.

1.5 The university component is a list of compulsory educational disciplines determined by the university independently for the mastering of the academic program.

1.6 The component of choice is a list of academic disciplines and the corresponding minimum amounts of academic credits offered by the university and independently chosen by students in any academic period, taking into account their prerequisites and postrequisites.

1.7 Elective disciplines are educational disciplines that are a part of the university component and the component of choice in the framework of established academic credits, introduced by organizations of education reflecting the individual preparation of students and taking into account the specifics of socio-economic development, the needs of a particular region and established scientific schools.

1.8 Postrequisites are the disciplines and (or) modules and other types of academic work, the study of which requires knowledge, skills and competencies acquired at the end of the study of this discipline and (or) modules;

1.9 Prerequisites are the disciplines and (or) modules and other types of educational work containing knowledge, abilities, skills and competencies necessary for the mastering of the studied discipline and (or) modules;

1.10 Competencies are the ability of the practical use of acquired knowledge and skills in professional activities.

2 ELECTIVE DISCIPLINES

№	Cycle of discipline	Code of discipline	Name of discipline	Semester	Number of credits	Prerequisites
<i>3 year</i>						
1	ПД	ANL6301	Introduction to data science	6	6	SFT6302
2	ПД	SFT6329	Introduction to quantum computing	6	6	MAT6006
3	ПД	EGR6301	Operating systems	6	6	SFT6306
4	ПД	NET6310	Linux Operating System	6	6	EEC6004
5	ПД	MIN601	Minor 1	5	5	
6	ПД	MIN602	Minor 2	6	5	
<i>4 курс</i>						
7	ПД	SEC6301	Fundamentals of information security	7	4	ANL6301
8	ПД	NET6304	Cloud Computing and Virtualization	7	4	SFT6329
9	ПД	SFT6319	Blockchain technology	7	5	EGR6301
10	ПД	SFT6321	QA testing	7	5	NET6310
11	ПД	MIN603	Minor 3	7	5	

3 DESCRIPTION OF ELECTIVE DISCIPLINES

Description of discipline	
Code of discipline	ANL6301
Name of discipline	Introduction to data science
Number of credits (ECTS)	6
Course, semester	3, 6
Department	KH
Prerequisites	Algorithms and Data Structures
Postrequisites	Fundamentals of information security
Brief course description	A basic understanding of machine learning and statistics. Studying data science methodology, open source tools for data science, the basics of mathematical statistics needed for machine learning. Constructing and testing hypotheses. The use of simple predictive models.
Expected learning outcomes	<ul style="list-style-type: none"> - Understanding the basic concepts of data science. - Knowledge of the basic tools and technologies for working with data. - Skills in conducting basic data analysis and visualization. - Knowledge of the basics of machine learning. - The ability to apply the acquired knowledge to real data processing tasks.

Description of discipline	
Code of discipline	SFT6329
Name of discipline	Introduction to quantum computing
Number of credits (ECTS)	6
Course, semester	3, 6
Department	KH
Prerequisites	Probability theory and mathematical statistics
Postrequisites	Cloud Computing and Virtualization
Brief course description	In the course, quantum computing will be considered more from the point of view of mathematics, rather than quantum physics, the main concepts on which quantum algorithms are built will be told, some existing quantum algorithms will be considered.
Expected learning outcomes	<p>Upon successful completion of the course, students will be able to:</p> <ul style="list-style-type: none"> - Understand the basics of quantum mechanics. - Knowledge of the principles of quantum computing and qubits. - Mastering basic quantum algorithms. - Quantum computer programming skills. - Practical application of knowledge in quantum computing tasks. - Critical thinking and analysis of the applicability of quantum methods. - Communication and collaboration skills in discussing

	quantum concepts and applications.
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Description of discipline	
Code of discipline	EGR6301
Name of discipline	Operating systems
Number of credits (ECTS)	6
Course, semester	3, 6
Department	KИ
Prerequisites	Software architecture and design
Postrequisites	Blockchain technology
Brief course description	Acquaintance with modern operating systems, their functionality and structure. Methods of process planning, interprocess communication, process synchronization, deadlock processing, main memory management during process execution, classical internal algorithms and storage management structures, and design of an input-output system are considered.
Expected learning outcomes	<p>Upon successful completion of the course, students will be able to:</p> <ul style="list-style-type: none"> - Understand the basic principles of operating systems. - Ability to manage processes, memory and file system. - Knowledge of the basic algorithms for task planning and resource management. - Command line skills and OS administration. - The ability to solve problems with the installation and configuration of operating systems. - Understanding the principles of interaction between hardware and software at the operating system level.

Description of discipline	
Code of discipline	NET6310
Name of discipline	Linux Operating System
Number of credits (ECTS)	6
Course, semester	3, 6
Department	KИ
Prerequisites	Fundamentals of logic design
Postrequisites	QA testing
Brief course description	The purpose of the discipline "Linux Operating System" is to teach students the basics of working and managing the Linux operating system. Upon completion of the course, students should have an understanding of the core concepts of Linux and be able to use it effectively in a variety of scenarios.
Expected learning outcomes	<p>Upon successful completion of the course, students will be able to:</p> <ul style="list-style-type: none"> - Understand the basic principles of Linux operating systems. - Skills in installing, configuring and managing Linux systems. - Ability to work with the Linux command line (terminal) and basic commands.

	<ul style="list-style-type: none"> - Knowledge of the basic concepts of multitasking, user access rights and Linux file systems. - The ability to configure network settings and system security. - Experience working with package managers and installing software on Linux. - Skills in solving typical Linux system administration and support tasks.
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Description of discipline	
Code of discipline	MIN601
Name of discipline	Minor 1
Number of credits (ECTS)	5
Course, semester	3, 5
Department	
Prerequisites	
Postrequisites	
Brief course description	Additional educational program (minor) - a set of disciplines and (or) modules and other types of educational work, determined by students for study in order to form additional competencies
Expected learning outcomes	

Description of discipline	
Code of discipline	MIN602
Name of discipline	Minor 2
Number of credits (ECTS)	5
Course, semester	3, 6
Department	
Prerequisites	
Postrequisites	
Brief course description	Additional educational program (minor) - a set of disciplines and (or) modules and other types of educational work, determined by students for study in order to form additional competencies
Expected learning outcomes	

Description of discipline	
Code of discipline	SEC6301
Name of discipline	Fundamentals of information security
Number of credits (ECTS)	4
Course, semester	4,7
Department	КИ
Prerequisites	Introduction to data science
Postrequisites	Diploma project
Brief course description	It covers basic security concepts, principles and technologies, cryptography, attack methods and security monitoring. Studying basic security methods for searching for threats on the network using various popular security tools in a real network infrastructure.
Expected learning outcomes	After successful completion of the course, students will: <ul style="list-style-type: none"> - Understanding the basic principles of information security. - The ability to identify and analyze vulnerabilities in information systems. - Skills to protect information from unauthorized access. - Knowledge of methods for detecting and preventing cyber attacks. - Readiness to respond to information security incidents. - The ability to apply cyber defense tools and methods to protect data and information systems.

Description of discipline	
Code of discipline	NET6304
Name of discipline	Cloud Computing and Virtualization
Number of credits (ECTS)	4
Course, semester	4, 7
Department	КИ
Prerequisites	Introduction to quantum computing
Postrequisites	Diploma project
Brief course description	Introductory course from Linux Foundation experts. Learning the basics of cloud computing, terminology, tools and technologies associated with modern cloud platforms. The course displays the entire cloudy landscape and explains how various tools and platforms interact with each other.
Expected learning outcomes	Upon successful completion of the course, students will be able to: <ul style="list-style-type: none"> - Understand the basic concepts of cloud computing and virtualization technologies. - The ability to deploy, manage and scale virtual resources in the cloud. - The ability to optimize the use of cloud resources to increase efficiency and reduce costs. - Skills in working with major cloud service platforms such as Amazon Web Services (AWS), Microsoft Azure or Google Cloud Platform. - Knowledge of methods for ensuring security and data

	<p>protection in a cloud environment.</p> <ul style="list-style-type: none"> - The ability to design and implement cloud architectures for various business tasks. - The ability to integrate cloud solutions with existing infrastructures and applications
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Description of discipline	
Code of discipline	SFT6319
Name of discipline	Blockchain technology
Number of credits (ECTS)	5
Course, semester	4, 7
Department	КИ
Prerequisites	Operating systems
Postrequisites	Diploma project
Brief course description	The Blockchain course is for those who want to learn more about blockchain technology and its applications. The course will look at how blockchain works, what its advantages and disadvantages are, what cryptocurrencies and tokens use blockchain, how to create and use smart contracts, and what are the examples of blockchain applications in various fields such as finance, logistics, medicine, etc. others
Expected learning outcomes	<p>Upon successful completion of the course, students will be able to:</p> <ul style="list-style-type: none"> - Understand the basic concepts of blockchain and its principles of operation. - The ability to develop and implement smart contracts. - Skills in working with various blockchain platforms and their development tools. - A deep understanding of security and privacy issues in the blockchain and ways to solve them. - The ability to analyze existing blockchain projects and develop your own solutions based on blockchain technology. - Understanding the potential of blockchain to solve real business problems and create innovative applications.

Description of discipline	
Code of discipline	SFT6321
Name of discipline	QA testing
Number of credits (ECTS)	5
Course, semester	4, 7
Department	КИ
Prerequisites	Linux Operating System
Postrequisites	Diploma project
Brief course description	This course includes theoretical and practical classes on the following topics: main types of testing; basics and classification of testing; testing principles; WEB-product testing; software development methodology; test design techniques; work with

	Requirements for the tester; compiling and working with checklists in practice; compiling and working with test cases in practice; compiling and working with bug reports in practice; compiling and working with test sets; work in the JIRA system, etc.
Expected learning outcomes	<p>After successful completion of the course, students will be able to:</p> <ul style="list-style-type: none"> - Identify defects and errors in the software. - Improving the quality of the product. - Increased confidence in the program's performance. - Ensuring compliance with customer requirements. - Optimization of the software development and release process. - Improve user experience and satisfaction. - Reducing the risks associated with entering the market of a faulty product. - Improve the productivity and efficiency of developers.

Description of discipline	
Code of discipline	MIN603
Name of discipline	Minor 3
Number of credits (ECTS)	5
Course, semester	4, 7
Department	
Prerequisites	
Postrequisites	
Brief course description	Additional educational program (minor) - a set of disciplines and (or) modules and other types of educational work, determined by students for study in order to form additional competencies
Expected learning outcomes	