ХАЛЫҚАРАЛЫҚ АҚПАРАТТЫҚ ТЕХНОЛОГИЯЛАР УНИВЕРСИТЕТІ
МЕЖДУНАРОДНЫЙ УНИВЕРСИТЕТ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ
INTERNATIONAL UNIVERSITY

Faculty of Computer Technology and Cybersecurity
Department of Computer Engineering

APPROVED BY
Vice-rector for academic affairs,
International Information
Technology University JSC
Mustafina A.K.
"19" march 2024

7M06101

Software Engineering

CATALOGUE OF ELECTIVE DISCIPLINES

2024 entry year

2024

The catalogue of elective disciplines for the specialty/AP 7M06101 Software Engineering 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 Computer Engineering department

minutes No. _____ from "____" _____2024

Head of Dep _____ T.T. Chinibayeva

CED compilers _____ T.T. Chinibayeva

_____ Mukhanov S.B.

The catalogue of elective disciplines was approved at a meeting of the Academic Council of JSC IITU

minutes No. _____ from "____" _____2024

Head of the Department for educational and methodological activity

_____ Ajibayeva A.SH.

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
1 year						
1	BD	SFT7305	DevOps	1	5	-
2	BD	SFT7315	Algorithms in graph theory	1	5	-
3	PD	SFT7307	Geographic Information Systems	1	6	OOP
4	PD	ANL 7308	Theory of mass service	1	6	-
5	PD	ANL7311	Generative-adversarial networks	2	5	Computer networks
6	PD	ANL7312	Markov chains and decision-making processes	2	5	-
7	PD	ANL7313	Mathematics for computational sciences	2	5	-
2 year						
8	BD	ANL7305	Machine Learning and Computer Statistics	3	5	Data Analysis Methods
9	PD	ANL7307	Web Data Analysis	3	5	Data Analysis Methods
10	PD	NET7304	Corporate Networks Design	3	5	-
11	PD	ANL7314	Quantum computing	3	5	-
12	PD	SFT7308	IoT and Artificial Intelligence	3	5	OOP
13	PD	NET7303	Enterprise Linux in Corporate Networks	3	5	OS
14	PD	SFT7314	Federated Computing	3	5	-

3 DESCRIPTION OF ELECTIVE DISCIPLINES

Description of discipline	
Code of discipline	SFT7305
Name of discipline	DevOps
Number of credits (ECTS)	5
Course, semester	1,1
Department	CE
Prerequisites	-
Postrequisites	-
Brief course description	This course examines the key concepts and principles of DevOps, organizational factors and automation tools in the development of software products in this way. After completing this course, master students will be able to synchronize the stages of software product development, QA, automate tasks, and apply a methodology that helps automate workflows, which will increase the speed and productivity of developers, testers and system administrators.
Expected learning outcomes	–

Description of discipline	
Code of discipline	SFT7315
Name of discipline	Algorithms in graph theory
Number of credits (ECTS)	5
Course, semester	1,1
Department	CE
Prerequisites	-
Postrequisites	-
Brief course description	During the course, the main concepts of graph theory, graph connectivity. Optimization tasks set graph theory: problems of finding optimal paths and location problems, algorithms from the solution are given. A special type of graph is considered - trees and related tasks with them: finding the shortest spanning tree and finding the maximum directed forest, as well as using trees for storing information.
Expected learning outcomes	–

Description of discipline	
Code of discipline	SFT7307
Name of discipline	Geoinformation systems
Number of credits (ECTS)	5
Course, semester	1, 2
Department	CE
Prerequisites	OOP
Postrequisites	Master thesis
Brief course description	The course introduces students to the basic ways of organizing, storing and modeling spatial data. The content of the discipline also covers a range of issues related to automated mapping and the use of geoinformation technologies in making management decisions.
Expected learning outcomes	After successful completion of the course students will be able to: – explain basic concepts of using GIS in mapping the earth in spatial terms and populating the GIS's system to access data; – create and access data in the GIS's system using an appropriate software package; – develop maps with industry standard legends; – acquire GIS's system information from databases, existing maps, and the Internet; – annotate output for finished maps, documents, and reports.

Description of discipline	
Code of discipline	ANL 7308
Name of discipline	Theory of mass service
Number of credits (ECTS)	6
Course, semester	1,1
Department	CE
Prerequisites	-
Postrequisites	-
Brief course description	The aim of this course is - Formation of skills of mathematical modelling of service processes and ability to assess the quality of service management using mathematical methods. Expected learning outcomes Upon successful completion of the course, students will be able to: - Knowledge of the elements of probability theory and the theory of random processes used in the study of mass service systems; - Ability to build mathematical models of WSC functioning, possession of analytical methods of calculation of service quality indicators and appropriate mathematical apparatus;
Expected learning outcomes	–

Description of discipline	
Code of discipline	ANL7311
Name of discipline	Generative-adversarial networks
Number of credits (ECTS)	5
Course, semester	1,2
Department	CE
Prerequisites	-
Postrequisites	-
Brief course description	This discipline is devoted to the latest methods of generative-adversarial networks, and their use to create realistic images and three-dimensional structures. Upon mastering the discipline students should know: the concept and organisation of the generative model; the concept and organisation of the discriminative model; be able to: train generative-adversarial networks and generate images using them, from basic handwritten digits, to restoration, correction, colouring of photographs; generate 3D. Expected learning outcomes Upon successful completion of the course, students will be able to: - Possess an advanced understanding of the principles of generative-adversarial networks, their structure and basic components. - Design and train generative-adversarial models for different types of data such as images, text, sound and others. - apply GSS in various domains such as computer vision, natural language processing, content generation and other creative applications. - tune and optimise GSS parameters to achieve better results in various tasks.
Expected learning outcomes	–

Description of discipline	
Code of discipline	ANL7312
Name of discipline	Markov chains and decision-making processes
Number of credits (ECTS)	5
Course, semester	1,2
Department	CE
Prerequisites	-
Postrequisites	-
Brief course description	This discipline involves the study of Markov chains, in which each element is completely determined by the previous one. These chains are widely used in the formulation of tasks of linking artificial intelligence to the behaviour of an agent in a certain environment, for example, a robot in a real environment, on which, for example, reinforcement learning is based. Expected learning outcomes Upon successful completion of the course, students will be able to:

	- work with methods of building probabilistic models describing stochastic dynamics of processes; - perform sampling and estimation; - develop a mass service system - be able to establish properties of solutions of stochastic systems.
Expected learning outcomes	–

Description of discipline	
Code of discipline	ANL7313
Name of discipline	Mathematics for computational sciences
Number of credits (ECTS)	5
Course, semester	1,2
Department	CE
Prerequisites	-
Postrequisites	-
Brief course description	This course covers an introduction to the mathematical courses required to master the specialised disciplines of computational sciences based on numerical solutions of deterministic and probabilistic equations of mathematical physics and applied models used in technical manufacturing and the financial sector, namely the theory of ordinary differential equations, their typification and basic methods of analytical solution and an introduction to partial differential equations. Expected learning outcomes Upon successful completion of the course, students will be able to: - Argue reasonably for the correct choice of solutions to mathematical and statistical problems; - critically evaluate their own and their team's activities, and be capable of self-education and self-development. - Create applications to software packages to optimise professional activities in the studied fields of sciences, conduct laboratory and numerical experiments, evaluate the accuracy and reliability of the results of modelling;
Expected learning outcomes	–

Description of discipline	
Code of discipline	ANL7307
Name of discipline	Web data analysis
Number of credits (ECTS)	5
Course, semester	2, 3
Department	CE
Prerequisites	Data analysis methods

Postrequisites	Master thesis
Brief course description	Studying web data mining methods for solving various problems of analytical processing, creating models for analyzing structured and semi-structured web data.
Expected learning outcomes	After successful completion of the course students will be able to: – discuss classic and recent developments in Web search and data mining; – apply statistical techniques to analyze complex information and social networks.

Description of discipline	
Code of discipline	NET7304
Name of discipline	Corporate Networks Design
Number of credits (ECTS)	5
Course, semester	2,3
Department	CE
Prerequisites	-
Postrequisites	-
Brief course description	The course is aimed at gaining knowledge and acquiring skills necessary for designing a corporate network, including modern solutions for addressing and routing. It covers concepts such as modern corporate networks, WANs, security services, network services, and SDA with software access.
Expected learning outcomes	–

Description of discipline	
Code of discipline	ANL7314
Name of discipline	Quantum computing
Number of credits (ECTS)	5
Course, semester	2,3
Department	CE
Prerequisites	-
Postrequisites	-
Brief course description	The course is aimed at obtaining knowledge and skills by master students, formation of theoretical knowledge on basic concepts and methods of quantum computing theory. Expected learning outcomes Upon successful completion of the course, students will be able to: - know the basic concepts, problem statements and research methods of quantum computation theory and quantum measurement theory; - possess practical skills of construction of N-qubit quantum circuits and calculation of probability distributions at quantum measurements; - master skills of analysing quantum algorithms and quantum information protocols.

Expected learning outcomes	–

Description of discipline	
Code of discipline	ANL7305
Name of discipline	Machine learning and computer statistics
Number of credits (ECTS)	5
Course, semester	1, 1
Department	CE
Prerequisites	Data analysis methods
Postrequisites	Master thesis
Brief course description	The course includes topics such as supervised learning (linear learning models, neural networks, reference vector machines); teaching without a teacher (clustering, reduction of dimension); learning theory (CV theory; large fields). It discusses modern areas of application of machine learning, such as robotic control, data mining, autonomous navigation, speech recognition, as well as text and web data processing.
Expected learning outcomes	After successful completion of the course students will be able to: – perform explanatory data analysis; – perform sampling and estimation; – create and test hypothesis; – visualize data in different ways; – implement basic ML algorithms from supervised learning methods; – build and apply predictive model on practical tasks.

Description of discipline	
Code of discipline	SFT7308
Name of discipline	IoT and artificial intelligence
Number of credits (ECTS)	5
Course, semester	2, 3
Department	CE
Prerequisites	OOP
Postrequisites	Master thesis
Brief course description	The aim of this course is to teach undergraduates advanced artificial intelligence methods that can be useful for industrial automation, environmental assessment, as well as for human-computer interaction, etc.
Expected learning outcomes	After successful completion of the course students will be able to:

	– give an overview of the field of artificial intelligence, its background, history, fundamental issues, challenges and main directions; – discuss basic concepts, methods and theories of AI related to IoT; – demonstrate the ability to apply a given subset of the theories, methods and principles discussed during the course.

Description of discipline	
Code of discipline	NET7303
Name of discipline	Enterprise Linux
Number of credits (ECTS)	5
Course, semester	2, 3
Department	CE
Prerequisites	Operating systems, Computer networks
Postrequisites	Master thesis
Brief course description	The course aims to study the administration of the Linux operating system. Attention is focused on the fundamental concepts of Linux and its main tasks. It discusses the application of the command line concept and enterprise level tools.
Expected learning outcomes	After successful completion of the course students will be able to: – write shell scripts for automated administration tasks; – install and delete software, create a new user and delete, using main and info pages; – apply Linux text editors (vim, nano and etc); explain the Linux access control/privilege mechanisms.

Description of discipline	
Code of discipline	SFT7314
Name of discipline	Federated Computing
Number of credits (ECTS)	5
Course, semester	2,3
Department	CE
Prerequisites	-
Postrequisites	-
Brief course description	The course aims to develop an understanding of the basic principles of federated computing, including secure data transfer and inter-device reconciliation. It also provides programming skills to implement federated algorithms. This may include the use of specialised libraries and frameworks. Expected learning outcomes Upon successful completion of the course, students will be able to: - Apply federated computing to specific tasks such as machine learning, data analysis, and natural language processing;

	- Be able to provide data security in federated computing, including encryption, authentication, and other techniques;
Expected learning outcomes	-