

Faculty of Computer Technology and Cybersecurity
Department of Computer Engineering

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7M06110

Computer Systems and Software Engineering

CATALOGUE OF ELECTIVE DISCIPLINES

2023 entry year

The catalogue of elective disciplines for the specialty/AP 7M06110 Computer Systems and 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

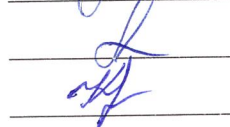
minutes No. 8 from "10" 02 2023

Head of Dep



T.T. Chinibayeva

CED compilers



T.T. Chinibayeva

L.A. Kozina

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

minutes No. 3 from "14" 03 2023

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	PD	ANL7306	Computer vision	1	5	Machine learning
2	PD	SFT7307	Geoinformation systems	1	5	OOP
3	PD	NET7302	Implementing enterprise advanced routing and services	1	5	Computer networks
4	PD	ANL7304	Natural language processing	2	5	Machine learning
5	PD	ANL7305	Machine learning and computer statistics	2	5	Data analysis methods
6	PD	NET7301	Implementing and operating enterprise network core technologies	2	5	Computer networks
2 year						
7	PD	SFT7308	IoT and artificial intelligence	3	5	OOP
8	PD	ANL7307	Web data analysis	3	5	Data analysis methods
9	PD	NET7303	Enterprise Linux	3	5	Operating systems Computer networks
10	PD	JUR7001	Effective communication	3	5	no
11	PD	JUR7002	Public speaking	3	5	no
12	PD	NET7304	Designing enterprise networks	3	5	Computer networks

3 DESCRIPTION OF ELECTIVE DISCIPLINES

Description of discipline	
Code of discipline	ANL7305
Name of discipline	Computer vision
Number of credits (ECTS)	5
Course, semester	1, 1
Department	CE
Prerequisites	Machine learning
Postrequisites	Master thesis
Brief course description	Introduction to computer vision, image and video analysis for the recognition, reconstruction and modeling of objects in a three-dimensional world. The basics of image formation, camera image geometry, detection and comparison of characteristics, image classification, deep learning using neural networks are considered.
Expected learning outcomes	After successful completion of the course students will be able to: <ul style="list-style-type: none"> – recognize and describe both the theoretical and practical aspects of computing with images; – describe the foundation of image formation and image analysis; – become familiar with the major technical approaches involved in computer vision; – describe various methods used for registration, alignment, and matching in images. – get an exposure to advanced concepts leading to object and scene categorization from images; – build computer vision applications.

Description of discipline	
Code of discipline	SFT7307
Name of discipline	Geoinformation systems
Number of credits (ECTS)	5
Course, semester	1, 1
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: <ul style="list-style-type: none"> – 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;

	<ul style="list-style-type: none"> - acquire GIS's system information from databases, existing maps, and the Internet; - annotate output for finished maps, documents, and reports.
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Description of discipline	
Code of discipline	NET7302
Name of discipline	Implementing enterprise advanced routing and services
Number of credits (ECTS)	5
Course, semester	1, 1
Department	CE
Prerequisites	Computer networks
Postrequisites	Master thesis
Brief course description	The course is aimed at obtaining undergraduates knowledge and the acquisition of the skills necessary for installing, configuring, operating and troubleshooting a corporate network. The course addresses advanced routing technologies and infrastructure.
Expected learning outcomes	<p>After successful completion of the course students will be able to:</p> <ul style="list-style-type: none"> - implement DHCPv4 to operate across multiple LANs; - explain, configure and troubleshoot advanced EIGRP, EIGRPv6, advanced OSPF, OSPFv3, advanced BGP, BGP; - troubleshoot Route Maps and Conditional forwarding issues; - configure route redistribution between routing protocols.

Description of discipline	
Code of discipline	ANL7304
Name of discipline	Natural language processing
Number of credits (ECTS)	5
Course, semester	1, 2
Department	CE
Prerequisites	Machine learning
Postrequisites	Master thesis
Brief course description	The basics of automatic processing of texts written in a natural language are considered. It is supposed to use ready-made applications for linguistic analysis, consider the principles of their work, as well as familiarity with the basic mathematical models that underlie modern computer linguistics.
Expected learning outcomes	<p>After successful completion of the course students will be able to:</p> <ul style="list-style-type: none"> - explain and apply approaches to syntax and semantics in NLP; - explain and apply approaches to discourse, generation, dialogue and summarization within NLP; - explain and apply current methods for statistical approaches to machine translation; - explain and apply machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP.

Description of discipline	
Code of discipline	ANL7305
Name of discipline	Machine learning and computer statistics
Number of credits (ECTS)	5
Course, semester	1, 2
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: <ul style="list-style-type: none"> - 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	NET7301
Name of discipline	Implementing and operating enterprise network core technologies
Number of credits (ECTS)	5
Course, semester	1, 2
Department	CE
Prerequisites	Computer networks
Postrequisites	Master thesis
Brief course description	The course is aimed at obtaining undergraduate knowledge and the acquisition of the skills necessary to configure, troubleshoot and manage wired and wireless networks of the enterprise. The course also discusses the principles of security in the enterprise network.
Expected learning outcomes	After successful completion of the course students will be able to: <ul style="list-style-type: none"> - configure spanning tree protocol in a switched environment (with protection mechanisms, multiple versions); - configure routers using different algorithms to determine the best path (EIGRP, OSPF, BGP), multicast operation; - explain the mechanisms used by QoS to ensure transmission quality; - configure IP services for managed networks that provide redundancy, address translation and synchronization.
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: <ul style="list-style-type: none"> – 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	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: <ul style="list-style-type: none"> – 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	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: <ul style="list-style-type: none"> – 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	JUR7001
Name of discipline	Effective communication
Number of credits (ECTS)	5
Course, semester	2, 3
Department	M&HK
Prerequisites	no
Postrequisites	Master thesis
Brief course description	The aim of the course is to form the basic knowledge, skills and practical skills of using modern communication strategies as a mechanism for building communication links between society and the subjects of the political and economic process.
Expected learning outcomes	After successful completion of the course students will be able to: <ul style="list-style-type: none"> – apply the techniques of interaction and influence that allow you to adequately respond to the situation, communicate freely and effectively; – effectively interact with people, use different behaviors; – holistically understand your own and common interests, set priorities and make choices.

Description of discipline	
Code of discipline	JUR7002
Name of discipline	Public speaking
Number of credits (ECTS)	5
Course, semester	2, 3
Department	M&HK
Prerequisites	no
Postrequisites	Master thesis
Brief course description	This course examines the purpose and characteristic features of public speech, methods of argumentation, speech means of logic and impact of speech, ethics of speech behavior of the speaker. The course is supported by an extended laboratory workshop.
Expected learning outcomes	After successful completion of the course students will be able to: <ul style="list-style-type: none"> – successfully choose and use of language tools; – effectively apply methods and approaches of argumentation; – demonstrate the skills of qualitative public speaking.

Description of discipline	
Code of discipline	NET7304
Name of discipline	Designing enterprise networks
Number of credits (ECTS)	5
Course, semester	2, 3
Department	CE
Prerequisites	Computer networks
Postrequisites	Master thesis
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	After successful completion of the course students will be able to: <ul style="list-style-type: none"> – configure overlay tunnels to secure site-to-site and remote access connectivity; – select appropriate wireless topologies and antennas, support and manage wireless roaming; – troubleshoot an enterprise network using common tools and techniques; – explain common network programmability concepts and programmatic methods of management.