Faculty of Digital Transformations
Department of Information Systems

APPROVED
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Educational Affairs
IITU
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«14» 03 2023.

EDUCATIONAL PROGRAM 8D06103

«INFORMATION SYSTEMS»

CATALOG OF ELECTIVE DISCIPLINES

2023 year of admission

2023

Catalog of elective disciplines for PhD students of educational program/EP 8D06103«Information systems» developed on the basis of the working curriculum of the specialty /8D06103« Information systems»

Catalog of elective disciplines for PhD students of educational program 8D06103« Information systems» discussed at the meeting of the Information Systems department

protocol № 3 «07» 02 2023.

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Catalog of elective disciplines for PhD students of educational program 8D06103« Information systems» approved at a meeting of the Educational and Methodological Council Of IITU protocol № 3 from «14» 03 2023

1 TERMS AND ABBREVIATIONS

1. 1 Educational program - a single set of basic characteristics of education, including goals, results and content of education, organization of the educational process, methods and methods for their implementation, criteria for assessing learning outcomes.

The content of the educational program of higher education consists of disciplines of three cycles - general education disciplines (hereinafter - GED), basic disciplines (hereinafter - BD) and major disciplines (hereinafter - MD).

General education disciplines includes disciplines of the mandatory component (hereinafter – MK), university component (hereinafter –UK) or elective disciplines (hereinafter – ED). BD and MD include disciplines MK and UK.

1. 2 Catalog of elective disciplines (CED) – a systematized annotated list of all disciplines of the elective component, for the entire period of study, containing their brief description indicating the purpose of the study, brief content and expected learning outcomes. CED includes prerequisites and postrequisites of each academic discipline. CED should provide students with the possibility of an alternative choice of elective academic disciplines for the formation of an individual educational trajectory. Based on the educational program and CED, students develop individual curricula with the help of advisors.

1. 3 Individual Curriculum Plan (ICP) – a curriculum formed for each academic year by students independently with the help of an advisor based on the educational program and the catalog of elective disciplines and (or) modules;

ICP determines the individual educational trajectory of each student separately. The IEP includes disciplines and types of educational activities (practices, research/experimental research work, forms of final certification) mandatory component (hereinafter – MK), university component (hereinafter –UK) or elective disciplines (hereinafter – ED).

1. 4 Advisor – a teacher acting as an academic mentor studying in the relevant educational program, assisting in choosing a learning path (formation of an individual curriculum) and development of the educational program during the period of study.

1. 5 Mandatory component – a list of compulsory academic disciplines determined by the university independently for the development of the educational program.

1. 6 University component – a list of academic disciplines and the corresponding minimum volumes of academic credits offered by the university, independently chosen by students in any academic period, taking into account their prerequisites and postrequisites.

1. 7 Elective disciplines – academic disciplines included in the university component and the elective component within the established academic credits and introduced by educational organizations, reflecting the individual training of the student, taking into account the specifics of socio-economic development and the needs of a particular region, established scientific schools.

1. 8 Postrequisite – disciplines and (or) modules and other types of educational work, the study of which requires knowledge, skills, abilities and competencies acquired upon completion of the study of this discipline and (or) modules;

1. 9 Prerequisite – disciplines and (or) modules and other types of educational work containing the knowledge, skills, abilities and competencies necessary for mastering the studied discipline and (or) modules;

1. 10 Competencies – the ability to apply the knowledge, skills and abilities acquired in the process of learning in professional activities.

2 ELECTIVE DISCIPLINES

№	The cycle of discipline	Discipline code	Name of the discipline	Semester	Credits	Prerequisite
1 курс						
1.	BD	ANL8006	Data mining	1	4	«Statistical data analysis»
2.	BD	ANL8103	Methods of analysis and processing of big data	1	4	"Database management systems", "Object-oriented programming".
3.	BD	ANL8104	Intelligent systems	1	4	"Programming technologies", "Theory of information processes and systems", "Mathematical foundations of systems theory", "Mathematical logic and theory of algorithms".
4.	BD	SFT8101	Theoretical computer engineering	1	4	"Database Management Systems", "Programming Technology", "Decision Theory", "Software Engineering"
5.	BD	SFT8100	Actual problems in forecasting	1	4	Data mining
6.	MD	SFT8102	Deep learning methods	1	4	"Machine learning", "Methods of automatic text processing", "Analysis and processing of unstructured data", "Neural networks" »
7.	MD	SFT8103	Modern management theory	1	4	«Project management»

3 DESCRIPTION OF ELECTIVE DISCIPLINES

	Description
Discipline code	ANL8006
Name of the discipline	Data mining
Credits (ESTS)	4
Course, Semester	1, 1
Department	Information systems
Author	
Prerequisite	«Statistical data analysis»
Postrequisite	Preparation of a PhD dissertation
Purpose	– formation of an idea among doctoral students about the types of tasks that arise in the field of data mining . – study of the main approaches and algorithms for solving data analysis problems and the features of their application to solving real problems. – acquisition by doctoral students of the skill to identify, formalize and successfully solve practical problems of data analysis that arise in the course of their professional activities.

	– obtaining practical skills in working with existing data analysis software packages.
Brief description of the course	The course studies classification, modeling and forecasting methods based on the use of decision trees, artificial neural networks, genetic algorithms, evolutionary programming, associative memory, fuzzy logic. Doctoral students will study methods of data analysis, including statistical methods: descriptive analysis, correlation and regression analysis, factor analysis, analysis of variance, component analysis, discriminant analysis, time series analysis, survival analysis, relationship analysis.
Expected results of the study	Know: Basic concepts; classification tasks; regression tasks; forecasting tasks; clustering problems; tasks of determining relationships; sequence analysis; deviation analysis. Be able to: apply software products of the following classes: specialized "boxed" software products for intellectual analysis; mathematical packages; spreadsheets (and various kinds of add-ons over them); tools integrated into database management systems (DBMS); other software products. Have skills: building econometric models, objects, phenomena and processes; build standard theoretical models and algorithms based on the description of situations, analyze and meaningfully interpret the results obtained.

Description	
Discipline code	ANL8103
Name of the discipline	Methods of analysis and processing of big data
Credits (ESTS)	4
Course, Semester	1, 1
Department	Information systems
Author	Naizabayeva L.K., professor
Prerequisite	"Database management systems", "Object-oriented programming".
Postrequisite	Preparation of a PhD dissertation
Purpose	The aim of the discipline is to develop doctoral skills in developing systems with a high degree of scalability that can receive, store and analyze large amounts of unstructured data in batch mode and / or in real time
Brief description of the course	The recent explosion of social media and the computerization of every aspect of economic activity has led to the creation of large volumes of mostly unstructured data: weblogs, videos, speech recordings, photographs, emails, tweets, and the like. In parallel development, computers are getting more powerful and storage is getting cheaper. Today, we have the ability to securely and cheaply store vast amounts of data, efficiently analyze it, and extract business and socially relevant information. This course introduces you to several key IT technologies that you can use to manipulate, store and analyze big data. The course introduces methods of data storage, effective analysis and extraction of business and socially significant information. The course introduces doctoral students to several key IT technologies for manipulating, storing and analyzing big data. The course covers MapReduce methods for parallel processing and Hadoop, an open source framework. Doctoral students will develop highly scalable systems to accept the storage and analysis of large volumes of unstructured data in batch and/or real-time.
Expected results of the study	- demonstrate knowledge of the fundamental concepts of big data management and analytics; - create parallel algorithms that can process very large amounts of data; - analyze very large volumes of data; - store data in Hadoop; - expand Hadoop;

	- administer Hadoop.

Description	
Discipline code	ANL8104
Name of the discipline	Intelligent systems
Credits (ESTS)	4
Course, Semester	1,1
Department	Information systems
Author	
Prerequisite	"Programming technologies", "Theory of information processes and systems", "Mathematical foundations of systems theory", "Mathematical logic and theory of algorithms".
Postrequisite	Preparation of a PhD dissertation
Purpose	to familiarize doctoral students with the problems and areas of use of artificial intelligence in information systems, highlight theoretical and organizational and methodological issues of building and functioning of knowledge processing systems, instilling skills in practical work on designing knowledge bases, as well as the development by doctoral students of a systematic approach to solving problems of knowledge engineering, the ability to navigate the whole variety of methods for constructing intelligent information systems (IIS) and their classification in order to choose the least time-consuming and, at the same time, adequate methodology for their synthesis and analysis, the formation of doctoral students skills
Brief description of the course	The course studies the representation of knowledge in information systems as an element of artificial intelligence and new information technologies, the classification of intelligent systems. Technology for the design and operation of intelligent systems. The course studies classes of intelligent systems: expert systems, artificial neural networks. calculation and logic systems, systems with genetic algorithms, natural language systems. Intelligent information systems are characterized by the following features: developed communication skills; the ability to solve complex poorly formalized problems; ability to self-learning; adaptability.
Expected results of the study	be able to: - set applied tasks in the field of intelligent information systems, justify their formulation, - choose a form of knowledge representation and a tool for developing IIS for a specific subject area; - design a knowledge base, choose a knowledge output strategy; - develop methods for maintaining the knowledge base in working condition. to get skills: - in the design of the knowledge base, its formalized description and content; - implementation of various strategies for knowledge output and explanation of the results obtained.

Description	
Discipline code	SFT8101
Name of the discipline	Theoretical computer engineering
Credits (ESTS)	4
Course, Semester	1, 1

Department	Information systems
Author	Sinchev B.K.,professor
Prerequisite	"Database Management Systems", "Programming Technology", "Decision Theory", "Software Engineering"
Postrequisite	Research, Preparation of a PhD dissertation
Purpose	Formation and development of general and professional competencies of a doctoral student in the field of "Theoretical Computer Engineering", who will be able to provide solutions to complex problems and practical problems of designing, building and configuring computer systems, use and implement computer engineering technologies.
Brief description of the course	The course is a challenging introduction to the basic ideas of theoretical computer engineering. In the course, doctoral students will become familiar with the most important areas and tools of modern computer engineering, along with the theory of algorithms, which includes the development and analysis of computational procedures; and complexity theory, which includes attempts to prove that there are no efficient algorithms in certain cases, and which investigates a classification system for computational problems. Time, memory, randomness, and concurrency are typical measures of computational cost. The course covers propositional logic, Turing machines and computability, finite automata, Gödel's theorems, efficient algorithms and reducibility, NP-completeness, P versus NP problems, decision trees and other specific computational models, power of randomness, cryptography and one-way functions, computational learning theories, interactive evidence and quantum computing and the physical limits of computing. .
Expected results of the study	Know: big data processing methods; principles of design and application of modern computer systems; principles of design and application of intelligent systems; principles of object-oriented programming; features of functioning of hybrid computer systems; features of building system software for the purpose of optimal organization of computing processes; computer-aided design systems for computer systems; fundamentals of the theory of experiment planning; algorithmic and other methods of computer modeling; modern technologies for creating software systems;.

Description	
Discipline code	SFT8100
Name of the discipline	Actual problems in forecasting
Credits (ESTS)	4
Course, Semester	1.1
Department	Information systems
Author	
Prerequisite	Data mining
Postrequisite	Research, Preparation of a PhD dissertation
Purpose	The purpose of the course: is to acquire by doctoral students the skills to use the acquired knowledge in solving the problems of forecasting socio-economic processes, the formation of a culture of scientific justification for making managerial decisions. Using the acquired skills in practical activities based on predictive information, as the basis for a preliminary assessment of the consequences of decisions made, the formation of doctoral students' knowledge in the field of applying models and forecasting methods to various practical problems.
Brief description of the course	In this discipline, doctoral students study the basic principles, construction features and scope of predictive models. The course provides a detailed overview and description of the classification and clustering of forecasting, and focuses on the practical problems involved in forecasting. Doctoral students will implement predictive models using Python and machine learning, as well as implement

	innovative engineering projects to develop predictive models for various purposes using modern design methods. In the process of learning activities, software implementation of predictive models is carried out to solve practical problems from various fields of application.
Expected results of the study	At the end of the course, the PhD student will receive the following learning outcomes: • conduct an analysis of the subject area; • conduct a comparative analysis of the subject area and determine the tasks for which it is advisable to use forecasting methods; determine the purpose, choose methods and tools for building predictive models; • be able to analyze socially significant problems and processes taking place in society and predict their possible development in the future. analyze and meaningfully interpret the results obtained with their further application in scientific research.

Description	
Discipline code	SFT8102
Name of the discipline	Deep learning methods
Credits (ESTS)	4
Course, Semester	1, 1
Department	Information systems
Author	Pashenko G.N.,assoc. proffesor.
Prerequisite	"Machine learning", "Methods of automatic text processing", "Analysis and processing of unstructured data", "Neural networks" »
Postrequisite	Preparation of a PhD dissertation
Purpose	The purpose of the discipline is to master the principles of building neural networks by a doctoral student, gaining knowledge of all types of neural networks and the skills to apply them in various tasks, gaining knowledge in the field of modern models of artificial neural networks, methods of their application for solutions to practical problems.
Brief description of the course	The course covers deep learning methods, training and deployment of neural networks. During the training, doctoral students will experiment with data, training parameters, neural network structure and other parameters to improve the performance and capabilities of neural networks, and deploy neural networks to solve real-world problems. Upon completion of the course, students will be able to solve their own problems using deep learning algorithms.
Expected results of the study	At the end of the course, the doctoral student will receive the following learning outcomes: - to analyze the subject area and determine the tasks for which it is advisable to use the mechanism of artificial neural networks; - choose methods and tools for building artificial neural networks; - analyze the computational capabilities of classical types of neural networks; - have knowledge in the field of modern models of artificial neural networks; - apply various methods for solving practical problems using neural networks;

Description	
Discipline code	SFT8103
Name of the discipline	Modern management theory
Credits (ESTS)	4
Course, Semester	1.1

Department	Information systems
Author	
Prerequisite	Project management»
Postrequisite	
Purpose	To form a scientific understanding of management as a science, art and a specific type of human activity, the stages and ways of its formation and development in the Republic of Kazakhstan and abroad, as well as to form basic practical skills in the field of modern management. To study the basic concepts and approaches to managing an organization, developed by science and management practice both abroad and in our country, to form a modern managerial outlook, thinking, skills in making and implementing managerial decisions.
Brief description of the course	Management theory is an applied scientific discipline that uses the results of research and development in other branches of science. The management theory course is connected with a number of humanitarian, general professional and special disciplines. The development of management theory takes place in close interaction with such scientific disciplines as: philosophy, sociology, organization theory, psychology, management, personnel management and many others. At the same time, the results of scientific research in the field of management theory are used in such disciplines as the public administration system, municipal management, personnel management, etc.
Expected results of the study	· the basic laws of management, their requirements, forms of their manifestation and use in the management of the organization; • fundamental principles of management, forms of their implementation and directions of development; • principles of goal setting, types and methods of planning • the essence and content of management, its features, goals, objectives and functions; • understand, analyze and justify the relationship between the main concepts and categories of management theory; • analyze the external and internal environment of the organization, identify its key elements and evaluate their impact on the organization; • organize team interaction to solve managerial problems