ХАЛЫҚАРАЛЫҚ АҚПАРАТТЫҚ ТЕХНОЛОГИЯЛАР УНИВЕРСИТЕТІ
МЕЖДУНАРОДНЫЙ УНИВЕРСИТЕТ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ
INTERNATIONAL UNIVERSITY OF INFORMATION TECHNOLOGY

Faculty of Computer Technologies and Cybersecurity
Department of "Mathematical and Computer Modeling"

APPROVED
Vice-rector for academic and educational affairs of
JSC "International University of Information Technologies"
_____ Umarov T.F.
(Signature) (FULL NAME.)
"30" 03 2021

_____ 6B06111 _____
(Code of the Educational program)

_____ Financial Mathematics _____
(Name of the Educational Program)

CATALOG OF ELECTIVE DISCIPLINE

2021 year of receipt

2021 н.

The catalog of elective disciplines for EP 6B06111 Financial mathematics is developed on the basis of the EP working curriculum.

The catalog of elective disciplines was discussed at a meeting of the Department of Mathematical and Computer Modeling

Minutes No. 8 dated March 05, 2021

Head of the Department _____ Ydyrys A.Zh.
signature Name, title, degree

Compiled by CED _____ Satybaldina A.N.
signature Name, title, degree

The catalog of elective disciplines was approved at a meeting of the Educational and Methodological Council of JSC "International University of Information Technologies"

Minutes No. 4 dated March 30, 2021.

Director of DAA _____ Mustafina A.K.
signature Name, title, degree

1 TERMS AND ABBREVIATIONS

1. 1 An educational program is a single complex of the main characteristics of education, including goals, results and content of education, organization of the educational process, methods and methods of 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 referred to as OOD), basic disciplines (hereinafter referred to as DB) and major disciplines (hereinafter referred to as PD).

The OOD cycle includes the disciplines of a compulsory component (hereinafter referred to as OK), a university component (hereinafter referred to as VC) and (or) an optional component (hereinafter referred to as CV). DB and PD include the disciplines of VK and KV.

1. 2 The catalog of elective disciplines (CED) is a systematized annotated list of all disciplines of the elective component for the entire period of study, containing a brief description of them indicating the purpose of the study, a summary (main sections) and expected learning outcomes. The CED reflects the prerequisites and postrequisites of each academic discipline. CED should provide educators with the opportunity to choose an alternative choice of elective academic disciplines for the formation of an individual educational trajectory.

Based on the educational program and CED, students, with the help of advisors, develop individual curricula.

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

IEP 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) of a mandatory component (OK), a university component (VC) and an optional component (CV).

1. 4 An adviser is a teacher who performs the functions of an academic mentor studying according to an appropriate educational program, assisting in the choice of a learning path (formation of an individual curriculum) and mastering the educational program during the training period.

1. 5 The university component is a list of compulsory academic disciplines determined by the university independently for mastering the educational program.

1. 6 Optional component - a list of academic disciplines and the corresponding minimum amount of academic credits offered by the university, independently selected by students in any academic period, taking into account their prerequisites and post-requisites.

1. 7 Elective disciplines are academic disciplines included in the university component and an optional component within the framework of 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 (postrequisite) - disciplines and (or) modules and other types of educational work, the study of which requires knowledge, abilities, skills and competencies acquired upon completion of the study of this discipline and (or) modules;

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

1. 10 Competencies - the ability to practically use the knowledge, skills and abilities acquired in the learning process in professional activities.

2 ELECTIVE DISCIPLINES

No.	Cycle of discipline	Discipline Code	Name of the discipline	Semester	Number of credits	Prerequisites
			2 course			
one	PD KV	CED6501	Elective №1 from CED	four	6	
		SFT6511	Java Programming 1			
		SFT6521	C # Programming 1			
			3 course			
2	PD KV	CED6502	Elective №2 from CED	five	6	Elective №1 from CED
		SFT6512	Java 2 Programming			Java Programming 1
		SFT6522	C # Programming 2			C # Programming 1
3	DB KV	CED6504	Elective №4 from CED	6	6	
		MAT6514	Financial Markets and Products			Introduction to Finance, Statistics 1
		MAT6524	Computational methods in finance			Introduction to Finance, Introduction to Programming
four	DB KV	CED6505	Elective №5 from CED	6	6	
		MAT6515	Fundamentals of Risk Management			Statistics 1
		MAT6525	Asset and liability management			Introduction to finance
			4 course			
five	PD KV	CED6503	Elective №3 from CED	7	6	
		MAT6513	Integration of business processes SAP			Information and communication technologies
		MAT6523	Operation research			Algebra and Geometry, Mathematical Analysis, Algorithms and Data Structures
6	PD KV	CED6506	Elective №6 from CED	7	6	
		MAT6516	Modeling financial tasks			Financial Markets and Products
		MAT6526	Nonlinear programming techniques			Introduction to Programming, Algorithms and Data Structures
7	PD KV	CED6508	Elective №8 from CED	7	6	
		MAT6518	Risk Assessments and Models			Fundamentals of Risk Management
		MAT6528	Fixed Income Securities			Asset and liability management
eight	PD KV	CED6507	Elective №7 from CED	eight	four	
		MAT6527	Dynamic programming			Operation Research, Introduction to

						Programming
		MAT6517	Numerical simulation on MatLab			Numerical Methods

3 DESCRIPTION OF ELECTIVE DISCIPLINES

Discipline description	
Discipline Code	SFT6511
Name of the discipline	Java Programming 1
Number of credits (ESTS)	6
Course, semester	2, 4
Department name	MKM
Course author (s)	Olzhaev O.M.
Prerequisites	-
Post-requisites	Java 2 Programming
The purpose of studying the discipline	The course will introduce students to object-oriented programming using Java. Students are expected to know the basics of scalar types (integers, strings, booleans) and fundamental control structures in procedural programming (loops, assignment statements, conditional expressions). Finally, it will include a short introduction to the Java Framework and Java JDBC.
Brief description of the course (main sections)	This course was designed to introduce the student to the Java language. Java GUI, Java Database will be studied in this course. Java's unique architecture allows programmers to develop a single application that can run smoothly and reliably across multiple platforms. In this hands-on course, students gain extensive experience with Java and its object-oriented features. Students learn to create robust console and graphical applications, and store and retrieve data from relational databases.
Expected results of the study (acquired by students knowledge, skills and competence)	□ Build robust console and graphical applications □ Understand the concept of OOP, as well as the purpose and principles of use inheritance, polymorphism, encapsulation and method overloading. □ Determine the classes, objects, members of the class and the relationships between them necessary for a specific problem. □ Build Java applications using robust OOP techniques (such as interfaces and APIs) and properly structuring the program (such as using access control identifiers, automatic documentation via comments, handling error exceptions).

Discipline description	
Discipline Code	SFT6521
Name of the discipline	C # Programming 1
Number of credits (ESTS)	6
Course, semester	2, 4
Department name	MKM
Course author (s)	Zhanabekov Zh.
Prerequisites	-
Post-requisites	C # programming 2
The purpose of studying the discipline	Create a knowledge system about the .NET Framework class library and the object-oriented C # .NET language. Generate knowledge and skills for developing applications using C # .NET. Develop understanding and taking advantage of the .NET platform.
Brief description of the course (main sections)	The course is designed to develop students' knowledge of some of the tools available in the .NET Framework Class Library. The course will also improve students' knowledge of the C # programming language and teach how to apply object-oriented architecture and design principles to .NET applications written in C # .NET.
Expected results of the study (acquired by students knowledge, skills and competence)	□ Creation of console / window applications in Visual Studio .NET; □ Create and use classes and objects in a C # application; □ Use the concepts of encapsulation, inheritance and polymorphism in console / window applications; □ Handling process error; □ Creature charts and so. □ Explain drawn up software documentation.

Discipline description	
Discipline Code	SFT6512
Name of the discipline	Java 2 Programming
Number of credits (ESTS)	6
Course, semester	3, 5
Department name	MKM
Course author (s)	Olzhaev O.
Prerequisites	Java Programming 1
Post-requisites	-
The purpose of studying the discipline	Development of the skills acquired by students in the framework of the courses "Programming in the Java 1 language", and improving the skills of programming in the Java language.
Brief description of the course (main sections)	The student will gain the skills necessary to work in real projects and understand what lies at the heart of many popular frameworks, how they work. Student get acquainted and study the architecture of different platforms.
Expected results of the study (acquired by students knowledge, skills and competence)	Students will learn how to design object-oriented applications and create Java programs using hands-on exercises and tools. And also high-level Java programming, writing class loader and unit tests.

Discipline description	
Discipline Code	SFT6522
Name of the discipline	C # programming 2
Number of credits (ESTS)	6
Course, semester	3, 5
Department name	MKM
Course author (s)	Zhanabekov Zh.
Prerequisites	C # Programming 1
Post-requisites	-
The purpose of studying the discipline	Development of the skills acquired by students in the framework of the courses "Programming in the C # 1 language", and improving the skills of programming in the C # language.
Brief description of the course (main sections)	The course examines in detail the capabilities of the language and auxiliary libraries that are most in demand when developing applications and autotests, including when testing web and windows applications through the user interface. The course will help you learn how powerful the combination of C # 5.0 and .NET 4.5 is.
Expected results of the study (acquired by students knowledge, skills and competence)	A large number of examples will help you when working with features of C # code such as generics, dynamic typing, and the new features of asynchronous programming. In addition, the student will learn about all the intricacies of working with XAML, ASP.NET, LINQ and other tools of the .NET platform.

Discipline description	
Discipline Code	MAT6514
Name of the discipline	Financial Markets and Products
Number of credits (ESTS)	6
Course, semester	3, 6
Department name	MKM
Course author (s)	Itasheva N.K.
Prerequisites	Introduction to Finance, Statistics 1
Post-requisites	Modeling financial tasks
The purpose of studying the discipline	Introduce students to the concept of concepts related to the money market, bond market, foreign market, stock market, derivatives markets.
Brief description of the course (main sections)	The course allows the student to gather key concepts about the financial markets, their products, prices, risks, and market participants. This provides practical support to be able to understand financial information as well as be able to work in financial markets. Students will learn how to make investment decisions by applying theory to the real world according to their needs and the characteristics of products and markets. As such, the course provides analytical skills to understand concepts related to the money market, bond market, foreign market, stock market, and derivatives markets.
Expected results of the study (acquired by students knowledge, skills and competence)	Learn how to make investment decisions by applying theory to the real world.

Discipline description	
Discipline Code	MAT6524
Name of the discipline	Computational methods in finance
Number of credits (ESTS)	6
Course, semester	3, 6
Department name	MKM
Course author (s)	Alpar S.D.
Prerequisites	Introduction to Finance, Introduction to Programming
Post-requisites	-
The purpose of studying the discipline	This course will provide an overview of numerical methods commonly used for mathematical finance, with emphasis on some of the fundamentally important computational schemes.
Brief description of the course (main sections)	The course includes random number generation, interpolation, integral and differential equations, optimization and modeling. Also seeks to implement a numerical algorithm in computational languages like Matlab or C ++
Expected results of the study (acquired by students knowledge, skills and competence)	Students will master the methods of computational mathematics in finance. They will learn how to draw up algorithms for solving financial problems, carry out numerical calculations and analyze the results obtained.

Discipline description	
Discipline Code	MAT6515
Name of the discipline	Fundamentals of Risk Management
Number of credits (ESTS)	6
Course, semester	3, 6
Department name	MKM
Course author (s)	Nartova D.S.
Prerequisites	Statistics 1
Post-requisites	Risk Assessments and Models
The purpose of studying the discipline	Objective: • To determine the risk • Risk analysis to identify the source and corrective actions • Assess the risk according to the severity and likelihood of occurrence • reduce and control the risk
Brief description of the course (main sections)	Risk management is the process of minimizing threats to the goals of an organization. Threats can come from many areas, including financial problems, cyberattacks, legal problems, natural disasters, competitors, personnel problems, and more. The risk manager must identify, evaluate and determine how best to mitigate each of these threats through a thorough and well-designed risk management process, which provides a course in the basics of risk management.
Expected results of the study (acquired by students knowledge, skills and competence)	Has an understanding of how to best assess each of the threats through a well-designed risk management process.

Discipline description	
Discipline Code	MAT6525
Name of the discipline	Asset and liability management
Number of credits (ESTS)	6
Course, semester	3, 6
Department name	MKM
Course author (s)	Itasheva N.K.
Prerequisites	Introduction to finance
Post-requisites	-
The purpose of studying the discipline	Provide students with concepts and tools to help them understand investment and asset models, with a focus on practical issues.
Brief description of the course (main sections)	This course covers the knowledge, skills, and judgment required to understand investment and asset modeling, with a focus on practical issues. It covers the development and monitoring of investment strategies for a range of liability profiles, including life insurance, general insurance and pension funds. Particular attention is paid to investment and asset issues that are relevant to liability management.
Expected results of the study (acquired by students knowledge, skills and competence)	At the end of this course, students will have an understanding of how to model investments and assets.

Discipline description	
Discipline Code	MAT6513
Name of the discipline	Integration of business processes SAP
Number of credits (ESTS)	6
Course, semester	4, 7
Department name	MKM
Course author (s)	Karashbaeva Zh.O.
Prerequisites	Information and communication technologies
Post-requisites	-
The purpose of studying the discipline	To acquaint students with important branches of the ERP system and its applications. Develop your knowledge and skills in SAP ERP systems in a way that encourages confidence and ensures satisfaction and pleasure. Develop an understanding of core principles and a high appreciation for SAP. During the educational process, students should become familiar with and be able to apply methods and tools to solve various problems.
Brief description of the course (main sections)	An Enterprise Resource Planning (ERP) system is software that manages all of the business areas of an organization, including Accounting and Finance, Human Resources, Sales and Distribution, Manufacturing, Purchasing, and Inventory. It's cross-functional, process-oriented, real-time, and based on industry best practices - from service to manufacturing to nonprofit. It is important that business and systems engineers have a working knowledge of these systems as they will be ERP users, auditors, consultants and / or developers in their careers. This course covers ERP theory and practice. The course content includes the evolution of ERP systems, business process reengineering, process mapping, ERP life cycle, ERP functionality, as well as audit and risk issues.
Expected results of the study (acquired by students knowledge, skills and competence)	• Understanding the technical aspects of ERP systems • Learn the concepts of reengineering and how they relate to the implementation of ERP systems. • Be able to map business processes using process mapping methods in SAP • Understand the activities and activities within the life cycle of a SAP system • Be able to identify and describe the typical functionality of an ERP system • Get hands-on experience with SAP transaction flow and SD, FI, CO, PP, HR, MM configuration.

Discipline description	
Discipline Code	MAT6523
Name of the discipline	Operation research
Number of credits (ESTS)	6
Course, semester	4, 7
Department name	MKM
Course author (s)	Satybaldina A.N.
Prerequisites	Algebra and Geometry, Mathematical Analysis, Algorithms and Data Structures
Post-requisites	Dynamic programming
The purpose of studying the discipline	- provide students with concepts and tools to help them understand operations research and mathematical modeling techniques. These methods will help students find answers to economic questions that will help them make appropriate decisions.
Brief description of the course (main sections)	The course is intended for third-year students in mathematics and computer modeling. Linear programming (LP; also called linear optimization) is a technique for achieving the best result (such as maximum profit or minimum cost) in a mathematical model whose requirements are represented by linear relationships. This course aims to familiarize students with linear optimization theory and its applications. The area of linear programming is the appropriate methods for efficiently calculating optimal solutions to a problem that is modeled by a linear objective function and a set of linear constraints. Linear programming is a special case of mathematical programming (mathematical optimization). Many practical problems in operations research can be expressed as linear programming problems. Some special cases of linear programming, such as network flow problems and multi-product flow problems, are considered important enough to warrant much research into specialized algorithms to solve them. A number of algorithms work to solve other types of optimization problems, while solving LP problems as subproblems.
Expected results of the study (acquired by students knowledge, skills and competence)	At the end of this course, students will be ready to model the problem as a linear programming problem and apply the appropriate method to find the optimal solution.

Discipline description	
Discipline Code	MAT6516
Name of the discipline	Modeling financial tasks
Number of credits (ESTS)	6
Course, semester	4, 7
Department name	MKM
Course author (s)	Itasheva N.K.
Prerequisites	Financial Markets and Products
Post-requisites	-
The purpose of studying the discipline	Teach students to model financial problems.
Brief description of the course (main sections)	The course is designed to provide students with an understanding of the practical foundations of financial modeling, to ensure the acquisition of practical skills in the preparation and application of applied financial models, their analysis and application for making managerial and operational decisions.
Expected results of the study (acquired by students knowledge, skills and competence)	Students will master the methods of drawing up financial problems, learn how to draw up algorithms for solving financial problems, carry out numerical calculations and analyze the results.

Discipline description	
Discipline Code	MAT6526
Name of the discipline	Nonlinear programming techniques
Number of credits (ESTS)	6
Course, semester	4, 7
Department name	MKM
Course author (s)	Rysbayuly B.
Prerequisites	Introduction to Programming, Algorithms and Data Structures
Post-requisites	-
The purpose of studying the discipline	To teach students to apply nonlinear programming methods in solving practical problems.
Brief description of the course (main sections)	In most problems, the construction of a mathematical model cannot be reduced to a linear programming problem. Mathematical models in the design problems of real objects or technological processes should reflect real physical and, as a rule, nonlinear processes occurring in them. The variables of these objects or processes are interconnected by physical nonlinear laws, such as the laws of conservation of mass or energy. They are limited to the limiting ranges that ensure the physical feasibility of a given object or process. As a result, most of the mathematical programming problems that are encountered in research projects and in design problems are nonlinear programming (NP) problems.
Expected results of the study (acquired by students knowledge, skills and competence)	Students will master nonlinear programming techniques for solving partial differential equations. They will learn how to draw up algorithms for solving equations, carry out numerical calculations and analyze the results obtained.

Discipline description	
Discipline Code	MAT6518
Name of the discipline	Risk Assessments and Models
Number of credits (ESTS)	6
Course, semester	4, 7
Department name	MKM
Course author (s)	Itasheva N.K.
Prerequisites	Fundamentals of Risk Management
Post-requisites	-
The purpose of studying the discipline	To familiarize students with risk assessment and financial problem models.
Brief description of the course (main sections)	The course covers topics such as assessing or modeling the risk arising from fluctuations in the market. Knowing a course in statistics is essential for this subject because the income distribution will be used to generate a non-parametric income distribution. The risk of individual portfolios will be studied by introducing the conditions Value at Risk and Expected Shortfall, which uses a parametric and non-parametric distribution of returns.
Expected results of the study (acquired by students knowledge, skills and competence)	At the end of this course, students will be ready to simulate risks arising from market fluctuations.

Discipline description	
Discipline Code	MAT6528
Name of the discipline	Fixed Income Securities
Number of credits (ESTS)	6
Course, semester	4, 7
Department name	MKM
Course author (s)	Itasheva N.K.
Prerequisites	Asset and liability management
Post-requisites	-
The purpose of studying the discipline	To acquaint students with the concept of securities.
Brief description of the course (main sections)	We present three types of exotic variants of geometric Brownian motion and develop detailed analyzes of each type. We also present and analyze the basic patterns of structural terms that are commonly used in practice.
Expected results of the study (acquired by students knowledge, skills and competence)	At the end of this course, students will have an understanding of how to analyze fixed income securities.

Discipline description	
Discipline Code	MAT6527
Name of the discipline	Dynamic programming
Number of credits (ESTS)	four
Course, semester	4, 8
Department name	MKM
Course author (s)	Satybaldina A.N.
Prerequisites	Operation Research, Introduction to Programming
Post-requisites	-
The purpose of studying the discipline	To acquaint students with dynamic (quadratic and convex) programming.
Brief description of the course (main sections)	Quadratic programming (QP) is the process of solving a special type of mathematical optimization problem, in particular, a quadratic optimization problem (with a linear constraint), that is, the problem of optimizing (minimizing or maximizing) a quadratic function of several variables subject to a linear constraint on these variables. Quadratic programming is a special type of nonlinear programming. If subproblems can be recursively nested within larger problems so that dynamic programming techniques are applicable, then there is a relationship between the value of the larger problem and the values of the subproblems.
Expected results of the study (acquired by students knowledge, skills and competence)	At the end of this course, students will be ready to apply dynamic programming technologies to solve various optimization problems.

Discipline description	
Discipline Code	MAT6517
Name of the discipline	Numerical simulation on MatLab
Number of credits (ESTS)	four
Course, semester	4, 8
Department name	MKM
Course author (s)	Nurtas M.
Prerequisites	Numerical Methods
Post-requisites	-
The purpose of studying the discipline	The course covers the computer and math tools needed to understand math and computer science research in Matlab, and to plan and execute independent research projects. Topics include mathematical modeling, description of applied software packages, description of animation and descriptor visualization of the calculation process, creation of a user interface.
Brief description of the course (main sections)	Matlab is a high-level programming language and interactive environment for numerical computing, visualization, and programming. Matlab allows matrix manipulation; graphing functions and data; implementation of algorithms; creation of user interfaces; interaction with programs written in other programming languages, including C, C ++, Java and Fortran; data analysis; development of algorithms; creation of models and applications.
Expected results of the study (acquired by students knowledge, skills and competence)	• develop a clear understanding of the fundamental concepts of multidimensional calculus using computer modeling in Matlab. • be able to set and solve optimization problems that include several variables, with or without constraints. • Solve the first-order linear ODE by integrating coefficients or varying parameters. • be skilled in modeling a simple system for obtaining first-order ODEs, 2D and 3D graphical visualization of solutions using directional fields and isoclines and their approximation by various methods.