

AGREED

by the Director of REDPRINT LLP  
(Digital Agency NIDGE)



M. Ryskeldi  
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APPROVED

by the Chairman of the Board, Rector of the  
JSC «International Information Technology



A.K. Khikmetov  
2023

## EDUCATIONAL PROGRAM

### 6B06112 “Data Science”

Code and classification of the field of education: 6B06 – Information and communication technologies

Code and classification of study area: 6B061 - Information and communication technologies

Group of educational programs: 057 – Information technologies

Level according to ISCE: 6

Level according to NQF: 6

Level according to SQF: 6

Duration of study: 4 years

Credits: 240

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**List of designations and abbreviations**

CD	Cycle of core disciplines
CC	Core competency
BM	Basic module
UC	University component
HE	Higher education
NMS	National Mandatory Standards of Higher and Post-Graduate Education
ATT	Additional types of training
EQF	European qualifications framework
EFE	European foundation for education
KSA	Knowledge, Skills and Abilities
FA	Final attestation
OC	Optional component
ISCED	International Standard Classification of Education
NQF	National qualifications framework
NQS	National qualifications system
GHM	General humanitarian module
RC	Required component
GEM	General education module
GED	Cycle of general education disciplines
AP	Academic program
GPM	General professional module
SQF	Sectoral qualifications framework
GEC	General education competence
M	Cycle of majors
PI	Professional internship
PS	Professional standard
PE	Postgraduate education
PC	Professional competence
PM	Professional module
LO	Learning outcome
QMS	Quality Management System

## 1. Description of the educational program

The need for the emergence of such a profession was dictated by the fact that when dealing with Ultra Big Data, the data arrays become too large to handle them via standard means of mathematical statistics. Everyday thousands of petabytes (10<sup>15</sup> bytes = 1024 terabytes) of information pass through the servers of companies all over the world. In addition to such data volumes, the problem is complicated by their heterogeneity and high update rate.

Data Scientist, like a real scientist, not only collects and analyzes data, but also studies them in different contexts and from different angles, questioning any assumptions. The most important quality of a data expert is the ability to see logical connections in the system of collected information, and to develop effective business solutions based on quantitative analysis. In today's competitive and fast-paced world, in the ever-growing flow of information, Data Scientist is indispensable for management to make the right business decisions. Individually, a statistician, a system analyst, or a business analyst cannot solve problems with such data volumes. This requires a person with an interdisciplinary education, competent in mathematics and statistics, economics and business, computer science and computer technology.

The main task of Data Scientist is the ability to extract the necessary information from a wide variety of sources, using information flows in real time; establish hidden patterns in data arrays and statistically analyze them to make competent business decisions. The workplace of such a specialist is not 1 computer or even 1 server, but a cluster of servers.

Our approach involves both covering the basic skills of the specialty MKM, and through the capabilities of the subjects of choice to cover the necessary elements of training in the field of "Data science".

At the same time, the student is left with the possibility of taking, at his discretion, additional subjects as free electives (free electives) - these may be subjects from any specialty.

Meetings conducted by the IITU marketing service and analysis of surveys conducted among graduates of the NIS, physical and mathematical schools showed that about 20 percent of graduates seriously think about the profession of "data analyst".

## 2. Purpose and objectives of the educational program

*The goal* of the Data Science educational program is to prepare highly qualified analysts and experts in the field of Data Science who have an understanding of the tasks of applied mathematics and economics, in particular those of the financial sphere, and who are creative in applying their knowledge and skills to successfully solving them.

The objectives of the educational program "Data Science" are:

- Getting students of good mathematical training.
- Formation of competences in various fields of programming and modern applied mathematics and computer science, such as data analysis and machine learning, software design and development.
- Acquisition of skills of professional work with big data and building analytical models for the financial sector of the economy.
- Training in work in the English-speaking environment, adaptation to the international education system.

### 3. Requirements for evaluating the learning outcomes of an educational program

By the end of the educational program “Data Science”, students will be able to:

- Argue the choice of basic standards, design principles and patterns, methods, tools and programming languages, including choosing methods and tools for constructing information protection systems of modern ICT.
- Apply mathematical models and methods of various processes;
- Create mathematical models using the methods of modern information technologies.
- To demonstrate sociability, initiative and psychological preparedness for work, including when working in a team and making management and technical decisions.
- Extract the necessary information from various sources, including information flows in real time.
- Analyze the information received.
- Have excellent programming skills.
- Be able to develop new algorithms.
- Process large amounts of information.
- Conduct multi-dimensional analysis.
- Ability to see the logical connection in the system of collected information.
- Possession of advanced analytical tools.

The following examination forms are used as an assessment of learning outcomes: computer testing, written exam (answers on the sheets), oral exam, project (passing a course project), practical (open questions on a computer, solving problems on a computer, including in ACM format) comprehensive (test / written / oral + others). In accordance with table 1, the following ratio of exam forms is recommended:

Table 1

№	Exam form	Recommended ratio, %
1	Computer testing	20%
2	Written exam	10%
3	Oral exam	5%
4	Project	30%
5	Practical	30%
6	Comprehensive	5%

Final certification ends with the defence of the graduation project.

#### 4. Passport of the educational program

##### 4.1 General information

№	Field name	Note
1	Code and classification of the field of education	6B06 – Information and communication technologies
2	Code and classification of study areas	061 – Information and communication technologies
3	Educational programs group	057 – Information technologies
4	Name of the educational program	6B06112 «Data Science»
5	Brief description of the educational program	<p>The main competences of the educational program «data Science»: the ability to extract relevant information from a variety of sources, using in for Discount streams in real-time; the ability to see the logical connection in the system of collected information; possession of excellent programming skills; possession of advanced analytical tools.</p> <p><i>Structure of the study program:</i></p> <ul style="list-style-type: none"> <li>• specialized knowledge in the field of mathematical statistics;</li> <li>• data visualization;</li> <li>• work with various programming languages, including R and Python;</li> <li>• machine learning;</li> <li>• multivariate analysis and linear algebra.</li> </ul>
6	Purpose of the EP	Preparation of highly qualified analysts and experts in the field of Data Sciences who have an understanding of the tasks of applied mathematics and economics, in particular the problems of the financial sphere, and who know how to creatively apply their knowledge and skills to successfully solving them.
7	Level according to ISCE	6
8	Level according to NQF	6
9	Level according to SQF	6
10	List of competences of the educational program:	<p>GC1: Know: social and ethical values based on public opinion, traditions, customs, social norms and focus on them in their professional activities; traditions and culture of the peoples of Kazakhstan; human and civil rights and freedoms; the basics of the legal system and legislation of Kazakhstan; trends in social development of society; the basics of physical culture and the principles of a healthy lifestyle.</p> <p>GC2: Have an idea: about ethical and spiritual values; about sociological approaches to the individual, the main laws and forms of regulation of social behavior; about the essence of power and political life, political relations and processes, the role of political systems in the life of society and various social groups; about the role of consciousness and self-awareness in the behavior, communication and activities of people, the formation and formation of personality.</p> <p>GC3: Possess: ethical and legal norms of behavior; a system of practical knowledge and skills that ensure the acquisition, development, improvement and activation of</p>

	<p>psychophysical abilities and qualities, the acquisition, preservation and promotion of health, the ability to work in a team, correctly defend their point of view, offer new solutions.</p> <p>GC4: Ability to write and communicate verbally in the state language and the language of international communication; ability to logically correctly, argumentatively and clearly build oral and written speech; readiness to use one of the foreign languages</p> <p>GC5: Ability to use modern information technologies, manage information using business applications; use network computer technologies, databases and application packages in their subject area.</p> <p>GC6: Ability to model financial and economic processes for solving specific tasks and predict financial and economic data using modern information technologies, computer technologies, databases and application software packages in their subject area.</p> <p>BC1: The ability to actually use the state language, the language of international communication and foreign language in professional activities.</p> <p>BC2: Ability to understand the basics of economic knowledge, scientific ideas about finance, economics.</p> <p>BC3: Ability to professional use of modern equipment, devices, network components, computer systems (in accordance with the objectives of the program), as well as use the rules of safety, industrial hygiene, fire safety and labor protection standards.</p> <p>BC4: Ability to possess skills of using algorithms and programs for calculating parameters of business processes.</p> <p>BC5: The ability to use the basic provisions and methods for solving problems, the ability to carry out project documentation in the software environment of computer graphics for various types of projects.</p> <p>BC6: The ability to be competent in the choice of mathematical modeling methods for solving specific problems, including the willingness to identify the natural scientific essence of the problems arising in the course of professional activity, and the ability to involve the appropriate physical and mathematical apparatus to solve it.</p> <p>BC7: The ability to develop information and software information systems based on modern methods and development tools.</p> <p>BC8: Ability to find limits, uncover uncertainties; differentiate and integrate basic elementary functions; investigate functions using differential calculus; apply the methods of differential and integral calculus in solving applied problems. be able to classify differential equations and apply the necessary methods to solve these equations; solve linear differential equations of order <math>n</math> and systems of linear equations with constant coefficients; find the quiescent points of the autonomous system;</p> <p>PC1: The ability to create mathematical models using the methods of modern information technologies;</p> <p>PC2: Ability to analyze received information;</p> <p>PC3: Ability to develop new algorithms;</p> <p>PC4: Ability to develop optimization methods and control algorithms;</p> <p>PC5: The ability to process large amounts of information;</p> <p>PC6: The ability to carry out multidimensional analysis, the ability to extract the necessary information from a wide variety of sources, using information flows in real time;</p> <p>PC7: The ability to see the logical connection in the system of collected information; possession of advanced analytical tools.</p> <p>PC8: The ability to apply the acquired knowledge in the selected additional educational program.</p>
11	<p>Educational program learning outcomes:</p> <p>LO1: To argue the choice of basic standards, principles and design patterns, methods, tools and programming languages, including choosing methods and tools for building</p>

	<p>information security systems of modern ICT.</p> <p>LO2: Apply mathematical models and methods of various processes</p> <p>LO3: Create mathematical models using the methods of modern information technologies.</p> <p>LO4: To demonstrate sociability, initiative and psychological preparedness for work, including when working in a team and making management and technical decisions.</p> <p>LO5: Extract the necessary information from various sources, including information flows in real time.</p> <p>LO6: Analyze the information received.</p> <p>LO7: Have excellent programming skills.</p> <p>LO8: Be able to develop new algorithms.</p> <p>LO9: Handle large amounts of information.</p> <p>LO10: Perform multidimensional analysis.</p> <p>LO11: The ability to see the logical connection in the system of collected information.</p> <p>LO12: Possession of advanced analytical tools.</p> <p>LO13: Is able to apply the acquired knowledge according to the selected additional educational program.</p> <p>LO14: Demonstrate the ability to conduct interdisciplinary scientific research using basic knowledge from the fields of economics and law, ecology and life safety. The ability to apply entrepreneurial qualities to the tasks of calculating the profitability of scientific projects. The ability to build personal and interpersonal relationships in compliance with an anti-corruption culture.</p>	
12	Mode of study	Full-time
13	Languages of study	English
14	Credits	240
15	Awarded academic degree	Bachelor of Information and Communication Technologies in the educational program "6B06112 - Data Science"
16	Developer (s) and authors:	<p>JSC International Information Technology University, Department of Mathematical and computer simulation:</p> <ul style="list-style-type: none"> <li>- Rysbayuly B.</li> <li>- Nurtas M.</li> <li>- Ydyrys A.Z.</li> <li>- Alpar S.D.</li> </ul>

#### 4.2 The matrix of correlation of the learning outcomes of educational programs with the forming competences

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14
<b>БК1</b>	V			V										
<b>БК2</b>		V			V	V				V				V
<b>БК3</b>	V		V				V					V		
<b>БК4</b>						V		V	V	V				
<b>БК5</b>	V	V	V								V			
<b>БК6</b>		V	V					V			V	V		
<b>БК7</b>			V				V					V		
<b>БК8</b>		V				V				V	V			
<b>ПК1</b>	V		V						V			V		



ПК2					V			V	V	V			
ПК3							V			V			
ПК4				V	V					V	V		
ПК5						V		V	V				
ПК6				V					V				
ПК7	V									V	V		
ПК8												V	

### 4.3 Information about the disciplines

№	Name of module / discipline	Brief description of discipline (30-50 words)	Number of credits	Formed competences (codes)	Prerequisites	Post requisites
<b>Cycle of general educational disciplines (GED)</b>						
<b>Required component (RC)</b>						
1.	History of Kazakhstan	This course consists of teaching the modern history of the country to understand the role and significance of the events in the historical context.	5	GC1	-	-
2.	Philosophy	This course consists of teaching philosophy to form a conscious attitude to the environment.	5	GC3	-	-
3.	Foreign language	This course consists of learning a foreign language for the formation of communication skills in a foreign language.	10	GC4	-	
4.	Kazakh (Russian) language	This Russian/Kazakh language course consists of teaching Kazakh / Russian language for the formation of communication skills in the state and Russian languages.	10	GC4		
5.	Information and communication technologies	The course provides an overview in various ICT fields, allowing students to gain basic knowledge on the application of modern ICT in their scientific and practical work, for self-study and other purposes.	5	GC5 BC3		
6.	Political science	The course provides students with knowledge about the political sphere of society, the relationship and mutual influence of politics and management	2	GC1 GC2 GC3		
7.	Sociology	This course consists of teaching sociology to understand society and social development.	2	GC2 GC3		
8.	Psychology	The course introduces various concepts, basic concepts, laws of management psychology	2	GC3		
9.	Culturology	The course forms the necessary knowledge of cultural studies, develops an understanding of the uniqueness of cultures	2	GC1		
10.	Physical culture	The course provides a solution to the main problems of physical education of students, provides for the delivery of control exercises and standards.	2	GC1 GC3		
<b>Cycle of General subjects (CGS)</b>						
<b>The university component (UC) and (or) the Component of choice (CC)</b>						
11.	Elective course #1 (CGS)		5			
	Economic theory	The course provides an overview of the principles and patterns of economic relations.		GC6 BC2		

	Startups and entrepreneurship	The course is designed to help students develop IT competencies, entrepreneurial skills, Teamwork, Business Skills and Softskills.		GC3		
	Fundamentals of law and anti-corruption culture	During the course, students will get acquainted with such concepts as anti-corruption consciousness and anti-corruption culture, acquire knowledge about corruption as a phenomenon of modern reality and its historical roots. The discipline forms the acquisition of skills to work with legislation in the field of anti-corruption, and develops a civic attitude to this phenomenon.		GC1 GC3		
	Fundamentals safety of life activity and ecology	This discipline is a higher school that studies ways of safe human interaction with the environment (industrial, household, urban, natural), the sustainable functioning of business facilities (organizations) in emergency situations, issues of protection from negative factors, prevention and elimination of consequences of natural and man-made emergencies and the use of modern means of destruction.		GC3		
	Research methodology	The course is devoted to the study of activities aimed at developing students' ability to make independent theoretical and practical judgments and conclusions, the ability to objectively evaluate scientific information, freedom of scientific search and the desire to apply scientific knowledge in educational activities, including for the completion of a thesis project (work).		GC3 BC5	-	-
<b>Cycle of basic disciplines University component</b>						
12.	Mathematical analysis 1	The aim of the course is to introduce students to the important branches of calculus and its applications in computer science. During the educational process, students should learn and be able to apply mathematical methods and tools to solve various applied problems. Moreover, they study fundamental methods of studying infinitesimal variables by means of analysis, which is based on the theory of differential and integral calculations.	6	BC6 BC8	-	Mathematical analysis 2
13.	Mathematical analysis 2	The course explains the basic concepts of a certain integral and its properties; use various mathematical methods to evaluate integrals, apply certain integrals to solve applied problems; develop numerical integration methods; define the concepts of infinite series, approximations of functions and the concept of convergence; apply infinite series in approximate calculations.	5	BC6 BC8	Mathematical analysis 1	
14.	Algebra and geometry	The course includes: matrix Theory, systems of linear equations, vector theory, analytical geometry, limit and differentiation of functions of one variable.	4	BC6	-	Operation research
15.	Differential equations	The course classifies differential equations and applies the necessary methods to solve these equations; teaches how to solve linear differential equations of the nth order and systems of linear equations with constant coefficients; find rest points of an autonomous	5	BC6 BC8	Mathematical analysis 1	Elective course

		system; solve boundary value problems for a linear homogeneous equation with constant coefficients; and use mathematical apparatus to master the theoretical foundations and practical use physical methods.				
16.	Object-oriented programming	The course includes: Encapsulation, inheritance, polymorphism. The creation of classes. Create useful client applets and stand-alone apps based on real-world requirements that students receive from real clients or employers.	7	BC7	Introduction to programming	Algorithms and data structures
17.	Computational mathematics	The course includes: Fundamentals of error theory, Systems of linear algebraic equations, Nonlinear equations and systems of nonlinear equations, Interpolation and best approximations, Differentiation and integration of functions, Ordinary differential equations, Equations of mathematical physics.	5	BC4 BC6	Differential equations	Numerical analysis
18.	Physics	The course covers topics such as: Kinematics; dynamics; circular motion and gravity; energy; momentum; simple harmonic oscillations; torque and rotational motion; electric charge and electric force; DC circuits; thermodynamics and mechanical waves, field and potential; electric circuits; induction of magnetism and electromagnetism; geometric and physical optics; and quantum, atomic and nuclear physics and sound.	4	BC6	-	-
19.	Numerical analysis	The following sections are studied in the course: The main tasks of mathematical physics. Difference schemes for parabolic type equations. Difference schemes for hyperbolic equations. Difference schemes for elliptic type equations. Variational and variational-difference methods. Iterative and variational methods for solving nonlinear problems of mathematical physics. Monte Carlo methods.	6	BC6 PC1	Computational mathematics	Elective course
20.	Algorithms and data structures	The process of studying the discipline is aimed at the formation of the following competencies: - the ability to search, store, process and analyze information from various sources and databases, to present it in the required format using information, computer and network technologies; - proficiency in reading, understanding and highlighting the main idea of the read source code, documentation.	6	BC4	Object-oriented programming	Elective course
21.	Introduction to Programming	The course is designed to form professional and general educational competencies of future specialists in the field of computer security through familiarization with the general principles of building and using programming languages, as well as developing skills in designing and implementing algorithms for solving practical problems in a software language, using assembly languages on modern computers.	6	BK7	-	Object-oriented programming
22.	Teaching practice	The practice includes detailing the finishing blocks of a generalized scheme, identifying the necessary classes and methods, defining sets of logically interconnected data (data streams), introducing various additional tools to ensure clarity and increase the level of service of the designed program, developing a generalized	2	BC4 BC6	-	-

		algorithm scheme, developing and debugging a program implementing the designed model.				
23.	WEB technology	The course includes the technology of designing the structure of the web-site as an information system; the technology of creating a web-site by means of programming on the client and server side; the technology of placement, support and maintenance of the web-site on the server.	6	BC7		
24.	Business correspondence in the state language	The course is dedicated to the activation and deepening of knowledge, skills and proficiency in the scientific style of speech of the Russian language, the formation of professional language competence.	2	BC1		
<b>Cycle of basic disciplines</b>						
<b>Component of choice</b>						
25.	Advanced Mathematics for Machine Learning	The course contains elements of algebra, statistics, elements of mathematical analysis (for example, gradient descent), elements of numerical method and analysis, an introduction to optimization problems, elements of vector space.	6	BC6 BC8	Statistics for data analysis	Elective courses
26.	English for STEM	The course is designed to help students develop their English language skills for their current and future academic studies. Improving the level of grammatical accuracy and developing listening, reading, writing and speaking skills in the IELTS format.	2	GC4 BC1		
27.	Professionally oriented foreign language	The course is devoted to the analysis of professional topics: "Computers and work", "Work in ICT", "Types of computer systems", "Basics of working with a computer", "Operating systems and graphical interface", "word Processing", "Cyberspace: security and crime", etc.	4	BC1		
28.	Probability theory	The course focuses on probability, as well as the relationship between mathematics and modeling, and operating systems as part of an interdisciplinary training program covering the mathematical analysis section.	3	BC6 PC5	-	Statistics for data analysis
29.	Statistics for data analysis	The course is devoted to statistics of any events, as well as the relationship between mathematics and modeling, operating systems within the framework of an interdisciplinary training program covering the section modern statistical methods and economic theory.	5	BC6 PC5 PC7	Probability theory	Elective courses
30.	Discrete mathematics and mathematical logic	Discrete mathematics is a part of mathematics devoted to the study of discrete objects (here discrete means consisting of separate or unrelated elements). More generally, discrete mathematics is used whenever objects are counted, when relationships between finite (or countable) sets are studied, and when processes involving a finite number of steps are analyzed. The main reason for the growing importance of discrete mathematics is that information is stored and processed by computing machines in a discrete manner.	6	BC6	-	Elective courses
31.	Data analysis and visualization in Power BI	An analyst is a specialist engaged in the study and modeling of a specific field. Power BI is an analytics system that combines data from various information sources, transforms them, and presents them in a visual form convenient	3	BC3 PC6 PC7	-	-

		<p>for analysis. BI technologies allow processing large unstructured amounts of data for decision-making.</p> <p>Power BI is a suite of Microsoft software services that work together to transform unrelated company data sources into holistic interactive reports.</p> <p>In this case, the source can be databases, Excel files, data from cloud sources and the Internet, text files, and so on. This tool helps you monitor the situation and get immediate answers to questions using detailed dashboards available on each device.</p>				
32.	Programming in Python	The purpose of the course is to develop programming skills in Python. As a result of mastering the discipline, the student must: know the basic constructions and idioms of the Python programming language and be able to put together a simple program in practice to perform an analytical task. Have the skills to formalize and solve practical programming problems	4	BC7	-	Python for data analysis
33.	Database theory	The course explains what a database system is, and then proceeds to most of the training material for the study of relational database systems - databases developed in accordance with the relational (or tabular) model. Then, from data abstraction, the course moves on to transaction management with additional materials to improve query performance. Finally, there are current trends in database system design, which also determine the latest developments in the broader history of data storage technologies.	5	BC5 BC7	-	Machine learning 1
34.	Python for data analysis	The course shows how to apply your programming skills to build predictive models, visualize data, and work with neural networks. The course is practice-oriented and will allow you to immediately start working with data and building models.	5	PC1 PC5 PC6 PC7	Programming in Python	Machine learning 1
35.	Operation research	The objectives are to master the basic concepts and methods of economic systems research; to study the current state and main directions of development of mathematical models of economic systems at various levels; to acquire the skills necessary for independent work on the design and implementation of economic analysis models and modeling algorithms; to develop a systematic type of thinking.	5	PC3 PC4	Algebra and geometry	Optimal management
36.	Machine learning 1	The course introduces students to the theoretical foundations and algorithms of machine learning, their possible practical implementations and applications in solving real problems. Within the framework of this course, students should get an idea of the problems solved with the help of the theory in question, and the principles of constructing some basic classifiers.	5	PC1 PC4 PC5	Python for data analysis	Machine learning 2, Neural Networks
<b>Cycle of major disciplines University component</b>						
37.	Industrial practice	The practice includes the study of the organizational structure and the complex of technical means of the information and analytical center (IAC) of the organization. Identification of the main tasks solved by the	4	BC5 PC1	-	-

		IAC. The study of the information support of the selected task (a set of tasks or a subsystem). The study of the mathematical support of the selected task (a set of tasks or a subsystem). The study of the software of the selected task (a set of tasks or a subsystem). The study of the organizational and legal support of the selected task (a set of tasks or a subsystem). systematization and analysis of factual materials necessary for writing a term paper, a scientific report and an internship report.				
38.	Professional Internship	The practice includes the study of the organizational structure and the complex of technical means of the information and analytical center (IAC) of the organization. Identification of the main tasks solved by the IAC. The study of the information support of the selected task (a set of tasks or a subsystem). The study of the mathematical support of the selected task (a set of tasks or a subsystem). The study of the software of the selected task (a set of tasks or a subsystem). The study of the organizational and legal support of the selected task (a set of tasks or a subsystem). systematization and analysis of factual materials necessary for writing a term paper, a scientific report and an internship report.	4	BC5 PC1	-	-
39.	Pregraduation practice	The practice includes the consolidation of theoretical knowledge in the academic disciplines of the specialty; mastering practical skills, technology of work in the specialty directly at the workplace using a PC, modern software and modern office equipment; studying and analyzing the real situation in the static and dynamics of CAD in the short and long term in relation to the enterprise – based internship; evaluating the commercial results achieved implementation of automation in the short and long term, in relation to these specific enterprises; familiarization with CAD development techniques and technology, procedures for making and implementing automation decisions at specific enterprises; collecting material for graduation projects.	5	BC5 PC1	-	-
<b>Cycle of major disciplines Component of choice</b>						
40.	Machine learning 2	The purpose of this course is to study the basics of machine learning theory, including discriminant, cluster and regression analysis, and to master the skills of practical solving data mining problems.	5	PC1 PC4 PC5	Mach ine learn ing 1	-
41.	Optimal management	The course provides the ability to use the basic methods of natural science disciplines in professional activities for theoretical and experimental research; the ability to use the appropriate mathematical apparatus and tools for processing, analyzing and systematizing information on the research topic.	5	BC6 PC1 PC4 PC6	Nume rical analy sis	-
42.	Exploratory data analysis	Exploratory data analysis refers to the critical process of performing initial data studies in order to identify patterns, identify anomalies, test hypotheses, and verify assumptions using	5	PC2 PC6 PC7	Pytho n for data analy	-

		summary statistics and graphical representations.			sis	
43.	Neural networks	The objectives of the course are to prepare students in the field of application of modern methods for solving difficult-to-formalize tasks that require large computing capacities. The course is aimed at preparing students to solve practical problems of data processing, mathematical modeling, computer science, obtaining higher professional education that allows graduates to successfully work in their chosen field of activity using modern computer technologies.	6	PC1 PC2	Mach ine learni ng 2	-
44.	Elective course #2		5			
	Deep Learning for Applied Mathematics	Deep learning is the dark magic of our days, incredibly powerful and accessible to almost everyone, not just giants like Google, Amazon or Tesla. And for companies themselves, when hiring employees in this area, it is important that a person has experience in solving realistic cases. The only necessary prior knowledge to complete this training program is a basic knowledge of Python syntax.		PC1 PC6 PC7	Progr ammi ng in Pytho n	
	Methods of nonlinear programming	Deep learning, of course, is based on mathematics, especially in its sections such as linear algebra, probability theory, statistics and mathematical analysis.		PC1 PC6 PC7	Progr ammi ng in Pytho n	
45.	Elective course #3		6			
	Deep learning of inverse problems	Approximate methods for solving inverse		PC1 PC6 PC7	Nume rical analy sis	
	Methods for solving inverse ill-posed problems	problems are being developed, algorithms are being compiled. Predict the solution of given tasks using machine learning. Computational experiments are carried out and the output data is analyzed.		PC1 PC6 PC7	Nume rical analy sis	
46.	Minor 1	Students choose from a list of minors of other EP.	5	PC8		
47.	Minor 2		5	PC8		
48.	Minor 3		5	PC8		

#### 4.4. List of modules and learning outcomes

Name of educational program: "Data Science"

Qualification: Bachelor in the field of information and communication technologies in the educational program "6B06112– Data Science".

Module Code / Module Name	The complexity of the module in credits	Learning outcomes	Criteria for assessing learning outcomes	Module-forming disciplines Code / Name
<b>GENERAL EDUCATION MODULES</b>				
OOM01 Sociology and Ethics	5	To have an idea of the principles and laws of the historical development of society, the historical periodization of the history of Kazakhstan, the place of the history of Kazakhstan in the world history and history of Eurasia He is capable of independently versatile and critical analysis of historical and modern sources, draw conclusions, and reason them.	Oral survey, testing, report, midterm control, semester works	The modern history of Kazakhstan
	5	Student has an idea of the subject, functions, main sections and directions of philosophy; place and role of philosophy in the life of society and man; the main stages of development of world and Kazakh philosophical thought. Able to operate with special philosophical terminology and categorical-conceptual apparatus of philosophy; - creatively and critically work on original philosophical texts; - Logically express your thoughts on the philosophical issues being studied; - analyze the features of the genesis and development of philosophical knowledge; - to form and argue for their own worldview.	Oral survey, testing, report, control, semester works	Philosophy
	2	Student has an idea of the subject, functions, main sections and directions of sociology; consists in the presentation of key approaches in the sociology of organizations both at the level of theoretical concepts and models, and at the level of empirical research; in introducing students to basic methods and techniques of research organizations Able - to be able to navigate in various sociological approaches to the analysis of organizations and literature for each approach; - gain skills of critical analysis of these approaches (understand their advantages and limitations);	Oral survey, testing, report, midterm control, semester works	Sociology



		<p>- get basic analytical skills of sociological research of organizations; - have an idea of the key research methods of organizations and their limitations.</p> <p>Student has an understanding of the subject, functions, and main sections; he must understand the basic concepts of politics and political science, the formation of the main political theories and concepts, learn the contribution that various thinkers made to the conceptual understanding of the most important problems of politics and society, the state and government</p> <p>Student is able to know the basics of scientific analysis of politics at both theoretical and applied levels, the possibilities of political analysis and forecasting methods for making optimal managerial decisions.</p> <p>Apply theoretical knowledge in real political practice at the level of analysis, examination, consulting, management;</p>		<p>Oral survey, testing, midterm report, control, semester works</p>	<p>Political science</p>
	2	<p>Student has an idea of the subject, functions, main sections and directions of psychology; the place and role of psychology in the life of society and man; Student able to form fundamental knowledge, skills and competencies required in professional activities; - the formation of environmental, physical and ethical, legal culture and a culture of thinking; - language training; - the formation of universal and socio-personal values;</p>		<p>Oral survey, testing, midterm report, control, semester works</p>	<p>Psychology</p>
	2	<p>Student has an idea about the subject of logically completed elements of the content of the discipline, provides a basis for determining the topics of the course, submitted for verification. Structuring the content of this academic discipline is also a prerequisite for the functioning of the rating system. In addition, such structuring helps the student to formulate a general idea of the development of world culture and systematize their knowledge.</p> <p>Able to give students an idea of the main problems of cultural theory; to reveal the objective laws of world and national cultural processes; to find out the genesis, functioning and development of culture as a specifically human way of life, which reveals itself historically as a process of cultural inheritance; to consider the cultural aspects of various areas of public life; to identify the features of the cultural life of different regions of the world, historical eras, cultural and historical types;</p>		<p>Oral survey, testing, midterm report, control, semester works</p>	<p>Cultural studies</p>
OOM02 Language Training	10	<p>Student able to characterize - the basic rules of reading; word-building models; contextual meanings of polysemantic words; terms and lexical constructions of the sublanguage corresponding to the profile of the studied specialty; the most</p>		<p>Oral survey, testing, midterm report, control, semester works</p>	<p>Foreign language</p>

		<p>frequent specific grammatical phenomena.</p> <p>To understand statements in a foreign language, especially compositional and semantic organization of a scientific text; basic techniques for isolating the main microtext information.</p>		
	10	<p>Identify language forms of expression of various types of information of a scientific text for solving problems of educational and professional communication; principles of compiling texts of the main educational, scientific, scientific and professional genres.</p>	<p>Oral survey, testing, midterm report, semester works</p>	Kazakh (Russian) language
	2	<p>Student able to characterize - the basic rules of reading; word-building models; contextual meanings of polysemantic words; terms and lexical constructions of the sublanguage corresponding to the profile of the studied specialty; the most frequent specific grammatical phenomena.</p> <p>To understand statements in a foreign language, especially compositional and semantic organization of a scientific text; basic techniques for isolating the main microtext information.</p>	<p>Oral survey, testing, midterm report, semester works</p>	Foreign language for STEM
	2	<p>Identify language forms of expression of various types of information of a scientific text for solving problems of educational and professional communication; principles of compiling texts of the main educational, scientific, scientific and professional genres.</p>	<p>Oral survey, testing, midterm report, semester works</p>	Business correspondence in the state language
	4	<p>Student able to characterize - the basic rules of reading; word-building models; contextual meanings of polysemantic words; terms and lexical constructions of the sublanguage corresponding to the profile of the studied specialty; the most frequent specific grammatical phenomena.</p> <p>To understand statements in a foreign language, especially compositional and semantic organization of a scientific text; basic techniques for isolating the main microtext information.</p>	<p>Oral survey, testing, midterm report, semester works</p>	Professionally-oriented foreign language
	5	<p>Student knows:</p> <ul style="list-style-type: none"> <li>- The main directions of ICT development;</li> <li>- the basics of using information resources for searching and storing information;</li> <li>- architecture and components of computer systems;</li> <li>- The main goals and objectives of information security.</li> </ul> <p>Able to work in any operating system and with databases; apply methods and means of information protection; work with spreadsheets, consolidate data, build charts.</p> <p>Student have skills:</p> <ul style="list-style-type: none"> <li>- processing of vector and raster images;</li> <li>- create multimedia presentations;</li> </ul>	<p>Oral survey, testing, milestone report control, settlement and graphic work</p>	Information and Communication Technologies (ICT)
<b>OOM03 Module of information technologies</b>				

		<ul style="list-style-type: none"> <li>- data visualization;</li> <li>- the use of various forms of e-learning to expand professional knowledge;</li> <li>- work with cloud services of E-technologies.</li> </ul>			
OOM04 Physical Training Module	8	Student knows the basic tasks of physical education of students, Can pass control exercises and standards.	Offset	Physical Culture	
	5	Have an idea of the principles and laws of economic relations.	Oral interview, testing, report, milestone control, calculation and graphic works	Fundamentals of economic theory	
	5	Have the ability to make independent theoretical and practical judgments and conclusions. Be able to objectively evaluate scientific information, freedom of scientific search and the desire to apply scientific knowledge in educational activities, including for the implementation of a diploma project (work).	Oral interview, report, milestone control	Research methodology	
	5	Have an understanding of the principles of law and anti-corruption culture	Oral interview, report, milestone control	Fundamentals of law and anti-corruption culture	
	5	Have an idea of the principles and patterns of ecology and life safety	Oral interview, report, milestone control	Fundamentals safety of life activity and ecology	
		Have an idea of IT competence, entrepreneurial skills	Oral interview, report, milestone control	Startups and entrepreneurs hip	
<b>BASIC MODULES</b>					
BM01 Module Physics and Mathematics	6, 5	Student able to describe the basic concepts of linear algebra and analytic geometry; basic fundamental concepts of mathematical analysis; limit theory; theory of continuous functions of one variable; differential calculus of a function of one real variable.	Oral survey, testing, milestone report control, settlement and graphic work	Mathematical Analysis 1, 2	
	4	Student able to apply methods for solving differential and integral calculus of the function of several variables in applied problems; apply methods for solving differential equations in solving applied problems; obtain approximate values of solutions by expanding in power series and Fourier series with a given accuracy;	Oral survey, testing, milestone report control, settlement and graphic work	Algebra and geometry	

		determine the best methods for solving practical problems. Student know: probabilistic and statistical methods in science; basic concepts of mathematical statistics; basic methods for constructing estimates; confidence interval construction methods; methods for constructing and testing statistical hypotheses.	Oral survey, testing, milestone report control, settlement and graphic work	Discrete mathematics and mathematical logic
6	3	Student knows: the basic principles, methods and results of modern probability theory and mathematical statistics. Be able to: calculate probabilities of random events and probabilistic characteristics random variables; process statistics; build adequate probabilistic and statistical models of real processes and phenomena, conduct their mathematical analysis; to assess the quality of the obtained solutions of applied problems. Own: methods of the classical theory of probability; the skill of mathematical formalization of applied problems, analysis and interpretation of the solutions of the corresponding mathematical models.	Oral survey, testing, milestone report control, settlement and graphic work	Probability theory
	5	Student knows: the basic principles, methods and results of modern probability theory and mathematical statistics. Be able to: calculate probabilities of random events and probabilistic characteristics random variables; process statistics; build adequate probabilistic and statistical models of real processes and phenomena, conduct their mathematical analysis; to assess the quality of the obtained solutions of applied problems. Own: methods of the classical theory of probability; the skill of mathematical formalization of applied problems, analysis and interpretation of the solutions of the corresponding mathematical models.	Oral survey, testing, milestone report control, settlement and graphic work	Differential equations
	4	Student knows and understands kinematics; dynamics; circular motion and gravity; energy; pulse; simple harmonic vibrations; torque and rotational motion; electric charge and electric force; DC circuits; thermodynamics and mechanical waves, field and potential; electrical circuits; induction of magnetism and electromagnetism; geometric and physical optics; and quantum, atomic and nuclear physics and sound.	Oral survey, testing, milestone report control, settlement and graphic work	Physics
BM02 Mathematical Modeling Module	5	Student knows and uses in modeling Fundamentals of the theory of errors, Systems of linear algebraic equations, Nonlinear equations and systems of	Oral survey, testing, milestone report	Computational Mathematics

		nonlinear equations, Interpolation and best approximations, Differentiation and integration of functions, Ordinary differential equations, Equations of mathematical physics.	control, settlement and graphic work	
	6	Student knows and uses in modeling Nonlinear equations and systems of nonlinear equations, Interpolation and best approximations, Differentiation and integration of functions, Ordinary differential equations, Equations of mathematical physics.	Oral survey, testing, milestone report control, settlement and graphic work	Numerical analysis
BM03 Computer Simulation Module	6	Student knows: organize, depending on the requirements of the task, the necessary data structures; Be able to: develop structural diagrams of various algorithms;	Oral survey, testing, milestone report control, settlement and graphic work	Programming Introduction
	7	Have skills: develop C ++ programs using language tools. Student able to develop sorting algorithms such as bubble sort, merge sort, quick sort, etc. Have the basics of OOP concepts, C ++ theory, methods and technologies, data structures and algorithms; application of algorithms and current trends in technologies of a large company	Oral survey, testing, milestone report control, settlement and graphic work	Object oriented programming
	6	Student able to know: basic algorithms for solving biological processes of various nature; Able to use tools of a programming language to solve biological problems and be able to perform data analysis, identify trends. Have skills: implementing algorithms and data structures, as well as using the functions of a programming language using modern software	Oral survey, testing, milestone report control, settlement and graphic work	Algorithms and data structures
	4	Student knows: Python programming language for working with genomic data; Unix operating system and commands for working in this environment; scripting languages and methods for writing program codes on them. He has programming skills for analysis of genes and genomes, the use of other additional packages, such as Biopython, R, Bioconductor and Galaxy.	Oral survey, testing, milestone report control, settlement and graphic work	Programming in Python
	5, 5	Know the basics of machine learning theory, including discriminant, cluster and regression analysis, mastery of skills for practical solving data mining problems.	Oral survey, testing, milestone report control, settlement and graphic work	Machine Learning 1, 2

	5	Student knows: the basic methods of numerical research of biological processes of various nature. Be able to: interpret the results of a numerical analysis of biological data, identify trends, make a forecast; Own: implement numerical methods using modern software.	Oral survey, testing, milestone report control, settlement and graphic work	Database theory
	6	Designs the structure of a web site as an information system. Knows the technology of creating a web site using client-side and server-side programming tools; the technology of hosting, supporting and maintaining a web site on the server.	Oral interview, testing, report, border control, calculation and graphic works	Web-technology
	5	Student knows: the basic methods of numerical research of biological processes of various nature. Be able to: interpret the results of a numerical analysis of biological data, identify trends, make a forecast; Own: implement numerical methods using modern software....	Oral survey, testing, milestone report control, settlement and graphic work	Python for data analysis
<b>PROFESSIONAL MODULES</b>				
PM01 Module of elective disciplines	5	Have professional skills	Oral survey, testing, milestone report control, settlement and graphic work	Elective course #2
	6			Elective course #3
PM02 Data Analysis Module	3	Student has an idea: on a comparative analysis in genomics of ideological and methodological criteria for understanding the structural subdivisions of the new science-structural genomics, proteomics and transcriptomics.	Oral survey, testing, milestone report control, settlement and graphic work	Data Analysis and Visualization in Power BI
	5	Student knows the basic concepts and methods of researching economic systems. He knows the state and main directions of development of mathematical models of economic systems at various levels. Has the skills necessary for independent work on the design and implementation of the economic analysis of models and modeling algorithms; systemic thinking. Student knows modern statistical methods and economic theory.		Operation research
	5			Statistics for data analysis
	6	Student knows elements of algebra, statistics, elements of mathematical analysis (for example, gradient descent), elements of the numerical method and analysis,		Advanced Mathematics

	optimization problems, elements of vector space.								for Machine Learning
	Student knows the mathematical apparatus and tools for processing, analyzing and systematizing information on the topic of research.	5							Optimal control
	Student solves the practical problems of data processing, mathematical modeling, computer science..	6							Neural networks
	Student able to identify patterns, identify anomalies, test hypotheses and test assumptions using summary statistics and graphical representations.	5							Exploratory data analysis
PM03 Practice module	Student knows the organizational structure and complex of technical means of the information-analytical center (IAC) of the organization.	2						Report	Training practice
	Able to identify the main tasks solved by the IAC.	4, 4							Industrial placement
	He knows the mathematical support of the selected task (task complex or subsystem) and the software of the selected task (task complex or subsystem), the organizational and legal support of the selected task (task complex or subsystem). systematization and analysis of the actual materials necessary for writing a term paper, a scientific report and a practice report.	5							Pre-diploma placement
PM04 The module of Minor disciplines	He is able to apply the acquired knowledge according to the selected additional educational program.	5, 5, 5					Oral interview, testing, report, boundary control	Minor 1, 2, 3	

## 5. Curriculum of the educational program

№	Module code	Module name in three languages (kaz / rus / eng)	Discipline Code	Discipline name in three languages (kaz / rus / eng)	Cycles (GED, CD, M)	Components (RC, OC, UC)	Total number of credits (ECTS)	Total number of academic hours	Number of classroom hours				Number of SIS hours		Form of control (Midterm, End-of-term, examination, CP defense, differential test, DP defense)	Prerequisites (Discipline Code)	
									Total number of classroom hours	lectures	practical classes (sem.)	laboratory classes	Total number of SIS hours	Including TSIS			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
<b>1 year</b>																	
<b>1 semester</b>																	
1	ООМ02	Тілдік дайындық / Языковая подготовка / Language training	LAN6001A	Шет тілі / Иностранный язык / Foreign language	CGS	RC	5	150	45	0	45	0	105	15	M, E, Exam	-	
2	ООМ03	Аппараттық технологиялар модулі / Модуль информационных технологий / Information Technology Module	ICT6001	Аппараттық-коммуникациялық технологиялар / Информационно-коммуникационные технологии / Information and Communication Technologies	CGS	RC	5	150	45	15	0	30	105	15	M, E, Exam	-	
3	БМ01	Физика - математикалық Модуль / Модуль Физико-математический / The Physics and Mathematics module	MAT6001	Алгебра және геометрия / Алгебра и геометрия / Algebra and Geometry	BD	UC	4	120	45	15	30	0	75	15	M, E, Exam	-	
4	БМ03	Компьютерлік модельдеу модулі / Модуль компьютерного моделирования / Computer simulation module	SFT6001	Бағдарламалауға кіріспе / Введение в программирование / Introduction to Programming	BD	UC	6	180	60	15	15	30	120	15	M, E, Exam	-	
5	БМ03	Компьютерлік модельдеу модулі / Модуль компьютерного моделирования / Computer simulation module	SFT6558	WEB технологиялары / WEB technology	BD	UC	6	180	60	15	15	30	120	15	M, E, Exam	-	
6	БМ01	Физика - математикалық Модуль / Модуль Физико-математический / The Physics and Mathematics	MAT6509	Дискреттік математика және математикалық логика / Дискретная математика и математическая логика /	BD	CC	6	180	60	30	30	0	120	15	M, E, Exam	-	



		module	Discrete Mathematics and Mathematical Logic		Total number for a 1 semester:											
					32	960	315	90	13	90	645	90				
<b>2 year</b>																
7	OOM02	Тілдік дайындық / Языковая подготовка / Language training	LAN6002A	Шет тілі / Иностранный язык / Foreign language	RC	5	150	45	0	45	0	105	15	M, E, Exam	-	
8	OOM04	Дене шынықтыру модулі / Модуль физической подготовки / Physical training module	PhC6005	Дене шынықтыру / Физическая культура / Physical Culture	RC	4	120	45	0	45	0	75	15	M, E, dif.test	-	
9	БМ01	Физика - математикалық Модуль / Модуль Физико-математический / The Physics and Mathematics module	MAT6501	Математикалық талдау 1 / Математический анализ 1 / Mathematical analysis 1	UC	6	180	60	30	30	0	120	15	M, E, Exam	-	
10	БМ01	Физика - математикалық Модуль / Модуль Физико-математический / The Physics and Mathematics module	PHY6001	Физика / Физика / Physics	UC	4	120	45	15	0	30	75	15	M, E, Exam	-	
11	ПМ03	Тәжірибе модулі / Модуль практик / The Practice module	PP6501	Оқыту практика / Учебная практика / Teaching practice	UC	2	60	30	0	30	0	30	0	Dif.test	-	
12	БМ01	Физика - математикалық Модуль / Модуль Физико-математический / The Physics and Mathematics module	MAT6520	Ықтималдық теориясы / Теория вероятности / Probability Theory	CC	3	90	30	15	15	0	60	15	M, E, Exam	-	
13	БМ03	Компьютерлік модельдеу модулі / Модуль компьютерного моделирования / Computer simulation module	SFT6516	Python бағдарламалау / Программирование на Python / Programming in Python	CC	4	120	45	15	0	30	75	15	M, E, Exam	-	
					<b>Total number for a 2 semester:</b>		<b>28</b>	<b>840</b>	<b>300</b>	<b>75</b>	<b>16</b>	<b>60</b>	<b>540</b>	<b>90</b>		
					<b>TOTAL NUMBER FOR THE 1 YEAR:</b>		<b>60</b>	<b>180</b>	<b>615</b>	<b>16</b>	<b>30</b>	<b>15</b>	<b>118</b>	<b>180</b>		
<b>2 year</b>																
<b>3 semester</b>																
14	OOM02	Тілдік дайындық / Языковая подготовка / Language training	LAN6001K R	Қазақ (орыс) тілі / Казахский (русский) язык / Kazakh (Russian) language	RC	5	150	45	0	45	0	105	15	M, E, Exam	-	
15	OOM01	Әлеуметтану және этика / Социология и этики / Sociology and Ethics	HK6002	Қазақстан тарихы / История Казахстана / History of Kazakhstan	RC	5	150	45	15	30	0	105	15	M, E, Exam	-	
16	OOM04	Дене шынықтыру модулі / Модуль физической подготовки / Physical training module	PhC6006	Дене шынықтыру / Физическая культура / Physical Culture	RC	4	120	45	0	45	0	75	15	M, E, dif.test	-	
17	БМ01	Физика - математикалық Модуль / Модуль Физико-математический /	MAT6502	Математикалық талдау 2 / Математический анализ 2 /	UC	5	150	45	15	30	0	105	15	M, E, Exam	MA T65	

	The Physics and Mathematics module		Mathematical analysis 2																
18	БМ03	Компьютерлік модельдеу модулі / Модуль компьютерного моделирования / Computer simulation module	SFT6517	BD	UC	7	210	75	15	30	30	135	15	M, E, Exam	SFT 600 I				
19	БМ01	Физика - математикалық Модуль / Модуль Физико-математический / The Physics and Mathematics module	МАТ6531	BD	UC	5	150	45	15	30	0	105	15	M, E, Exam	МА Т65 01				
			<b>Total number for a 3 semester:</b>			<b>31</b>	<b>930</b>	<b>300</b>	<b>60</b>	<b>210</b>	<b>30</b>	<b>630</b>	<b>90</b>						
<b>4 semester</b>																			
20	ООМ02	Тілдік дайындық / Языковая подготовка / Language training	LAN6002K R	CGS	RC	5	150	45	0	45	0	105	15	M, E, Exam	-				
21	ООМ01	Әлеуметтану және этика / Социологии и этики / Sociology and Ethics	SPS6003	CGS	RC	2	60	30	15	15	0	30	15	M, E, Exam	-				
22	ООМ01	Әлеуметтану және этика / Социологии и этики / Sociology and Ethics	SPS6002	CGS	RC	2	60	30	15	15	0	30	15	M, E, Exam	-				
23	БМ03	Компьютерлік модельдеу модулі / Модуль компьютерного моделирования / Computer simulation module	SFT6501	BD	UC	6	180	60	15	15	30	120	15	M, E, Exam	SFT 651 7				
24	БМ02	Математикалық модельдеу модулі / Модуль математического моделирования / Mathematical modeling module	МАТ6534	BD	UC	5	150	45	15	15	15	105	15	M, E, Exam	МА Т65 31				
25	ПМ03	Тәжірибе модулі / Модуль практик / The Practice module	PP6502	MD	UC	4	120	0	0	0	0	120	15	report	-				
26	ПМ02	Деректерді талдау модулі / Модуль Анализа данных / Data Analysis Module	МАТ6507	BD	CC	5	150	45	15	30	0	105	15	M, E, Exam	МА Т65 20				
			<b>Total number for a 4 semester:</b>			<b>29</b>	<b>870</b>	<b>255</b>	<b>75</b>	<b>135</b>	<b>45</b>	<b>615</b>	<b>105</b>						
			<b>TOTAL NUMBER FOR THE 2 YEAR:</b>			<b>60</b>	<b>1800</b>	<b>555</b>	<b>135</b>	<b>345</b>	<b>75</b>	<b>1245</b>	<b>195</b>						
<b>3 year</b>																			
<b>5 semester</b>																			
27	ООМ01	Әлеуметтану және этика / Социологии и этики / Sociology	SPS6005	CGS	RC	2	60	30	15	15	0	30	15	M, E, Exam	-				

28	ООМ01	and Ethics	Әлеуметтану және этика / Социология и этики / Sociology and Ethics	SPS6004	Мәдениеттану / Культурология / Cultural studies	CGS	RC	2	60	30	15	15	0	30	15	M, E, Exam	-
29	ООМ05	Зертеу және кәсіпкерлік модулі / Модуль исследований и предпринимательства / Research and Entrepreneurship Module	Зертеу әдістемесі / Методология исследования / Research methodology Тіршілік қауіпсіздігінің және экологияның негіздері / Основы экологии и безопасности жизнедеятельности / Fundamentals safety of life activity and ecology JUR 6470 Заң және сыбайлас жемқорлыққа қарсы мәдениеттің негіздері / Основы права и антикоррупционной культуры / Fundamentals of law and anti- corruption culture JUR 6470 Стартаптар және кәсіпкерлік / Стартапы и предпринимательство / Startups and entrepreneurship MGT6706 Экономикалық теория / Economic theory ECO6006	CGS	CC	5	150	45	15	30	15	30	0	105	15	M, E, Exam	-
30	ООМ02	Тілдік дайындық / Языковая подготовка / Language training	LAN6002P A	BD	CC	4	120	45	0	45	0	75	0	15	15	M, E, Exam	-
31	БМ03	Компьютерлік модельдеу модулі / Модуль компьютерного моделирования / Computer simulation module	SFT6503	BD	CC	5	150	45	15	0	30	105	0	15	15	M, E, Exam	SFT 651 6
32	БМ03	Компьютерлік модельдеу модулі / Модуль компьютерного моделирования / Computer simulation module	SFT6507	BD	CC	5	150	45	15	15	15	105	15	15	15	M, E, Exam	SFT 650 1
33	ПМ04	Майнор пәндер модулі / Модуль Майнор дисциплин / The module of Minor disciplines	MIN601	MD	CC	5	150	45	15	15	15	105	15	15	15	M, E, Exam	-
			<b>Total number for a 5 semester:</b>			<b>28</b>	<b>840</b>	<b>285</b>	<b>90</b>	<b>13</b>	<b>5</b>	<b>60</b>	<b>555</b>	<b>105</b>			
<b>6 semester</b>																	
34	ООМ01	Әлеуметтану және этика / Социология и этики / Sociology and Ethics	SPS6001	CGS	RC	5	150	45	15	30	0	105	15	15	15	M, E, Exam	-

35	БМ02	Математикалык модельдеу модулі / Модуль математического моделирования / Mathematical modeling module	МАТ6506	Сандык талдау / Численный анализ / Numerical analysis	BD	UC	6	180	60	15	15	30	120	15	M, E, Exam	MA T65 34	
36	ПМ03	Тәжірибе модулі / Модуль практик / The Practise module	PP6503	Өндірістік практика / Производственная практика / Professional Internship	MD	UC	4	120	0	0	0	0	120	15	report		
37	БМ03	Компьютерлік модельдеу модулі / Модуль компьютерного моделирования / Computer simulation module	SFT6508	Машиналык окутуу 1 / Машинное обучение 1 / Machine Learning 1	BD	CC	5	150	45	15	0	30	105	15	M, E, Exam	SFT 650 3	
38	ПМ02	Деректерді талдау модулі / Модуль Анализа данных / Data Analysis Module	МАТ6535	Машиналык окутууга арналган озык математика / Продвинутая математика для Машинного обучения / Advanced Mathematics for Machine Learning	BD	CC	5	150	45	15	30	0	105	15	M, E, Exam	MA T65 07	
39	ООМ02	Тілдік дайындык / Языковая подготовка / Language training	LAN6004D A	STEM арналган ағылшын тілі / Английский язык для STEM / English for STEM	BD	CC	2	60	30	0	30	0	30	15	M, E, Exam	-	
40	ПМ04	Майнор пәндер модулі / Модуль Майнор дисциплин / The module of Minor disciplines	MIN602	Майнор 2 / Майнор 2 / Minor 2	MD	CC	5	150	45	15	15	15	105	15	M, E, Exam	MI N60 1	
							<b>Total number for a 6 semester:</b>							<b>105</b>			
							<b>TOTAL NUMBER FOR THE 3 YEAR:</b>							<b>124</b>	<b>210</b>		

## 4 year

## 7 semester

41	ООМ02	Тілдік дайындык / Языковая подготовка / Language training	LAN6007K	Мемлекеттік тілде іс қағаздарын жүргізу / Делопроизводство на государственном языке / Business correspondence in the state language	BD	UC	2	60	30	0	30	0	30	15	M, E, Exam	LA N60 02K R
42	ПМ02	Деректерді талдау модулі / Модуль Анализа данных / Data Analysis Module	МАТ6538	Операцияларды зерттеу / Исследование операций / Operation research	BD	CC	5	150	45	15	15	15	105	15	M, E, Exam	MA T65 06
43	ПМ01	Элективті пәндер модулі / Модуль элективных дисциплин / The module of elective disciplines	МАТ6546 МАТ6536	Қолданбалы математиканы терең оқыту / Глубокое обучение для прикладной математики / Deep learning for Applied Mathematics Сызықты емес бағдарламалау әдістері / Методы нелинейного программирования / Methods of nonlinear programming	MD	CC	5	150	45	15	15	15	105	15	M, E, Exam	SFT 651 6

44	БМ03	Компьютерлік модельдеу модулі / Модуль компьютерного моделирования / Computer simulation module	SFT6540	Машиналық оқыту 2 / Машинное обучение 2 / Machine learning 2	MD	CC	5	150	45	15	15	15	105	15	M, E, Exam	SFT 650 8
45	ПМ02	Деректерді талдау модулі / Модуль Анализа данных / Data Analysis Module	SFT6526	Деректерді барлау талдауы / Исследовательский анализ данных / Exploratory data analysis	MD	CC	5	150	45	15	15	15	105	15	M, E, Exam	SFT 650 3
46	ПМ02	Деректерді талдау модулі / Модуль Анализа данных / Data Analysis Module	SFT6527	Оптималды басқару / Оптимальное управление / Optimal management	MD	CC	5	150	45	15	30	0	105	15	M, E, Exam	MA T65 06
47	ПМ04	Майнор пәндер модулі / Модуль Майнор дисциплин / The module of Minor disciplines	MIN603	Майнор 3 / Майнор 3 / Minor 3	MD	CC	5	150	45	15	15	15	105	15	M, E, Exam	MI N60 2
				<b>Total number for a 7 semester:</b>			<b>32</b>	<b>960</b>	<b>300</b>	<b>90</b>	<b>13</b>	<b>5</b>	<b>660</b>	<b>105</b>		
<b>8 semester</b>																
48	ПМ03	Тәжірибе модулі / Модуль практик / The Practice module	PP6504	Диплом алдындағы практика / Преддипломная практика / Pregraduation practice	MD	UC	5	150	0	0	0	0	150	15	report	
49	ПМ02	Деректерді талдау модулі / Модуль Анализа данных / Data Analysis Module	SFT6506	Power BI деректерді талдау және визуализациялау / Анализ и визуализация данных в Power BI / Data analysis and visualization in Power BI	BD	CC	3	90	30	0	30	0	60	15	M, E, Exam	-
50	ПМ01	Элективті пәндер модулі / Модуль элективных дисциплин / The module of elective disciplines	МАТ6542 МАТ6532	Кері есептерді терең оқыту / Глубокое обучение обратных задач / Deep learning of inverse problems Кері бұрыс есептерді шешу әдістері / Методы решения обратных некорректных задач / Methods for solving inverse ill-posed problems	MD	CC	6	180	60	15	15	30	120	15	M, E, Exam	MA T65 06
51	ПМ02	Деректерді талдау модулі / Модуль Анализа данных / Data Analysis Module	SFT6520	Нейрондық желілер / Нейронные сети / Neural Networks	MD	CC	6	180	60	15	15	30	120	15	M, E, Exam	SFT 654 0
52				Дипломдық жұмысты, дипломдық жобаны жазу және қорғау немесе кешенді емтиханды дайындау және тапсыру / Написание и защита дипломной работы, дипломного проекта или подготовка и сдача комплексного экзамена / Writing and defending a diploma thesis, diploma			<b>8</b>	<b>240</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>240</b>	<b>15</b>	DP Defence	

			project or preparation and passing of a comprehensive exam													
			Total number for a 8 semester:													
			TOTAL NUMBER FOR THE 4 YEAR:													
			TOTAL:													
			28	840	150	30	60	60	690	75						
			60	180	450	12	19	13	135	180						
			240	720	217	58	10	49	502	765						
			0	0	5	5	95	5	5	5						

Summary table of indicators of the academic program's number of credits in the context of cycles of disciplines and semesters

Cycles of disciplines / Semester	1 sem.	2 sem.	3 sem.	4 sem.	5 sem.	6 sem.	7 sem.	8 sem.	Total number of credits ECTS	Note (AP structure according to the National Mandatory Standards of Higher and Post-Graduate Education)
<b>Cycle of general education disciplines (GED)</b>	10	9	14	9	9	5			56	* 56 cr.
- including the required component (GED RC)	10	9	14	9	4	5			51	* 51 cr.
- including optional component (GED OC)					5				5	* 5 cr.
<b>Cycle of core disciplines (CD)</b>	22	19	17	16	14	18	7	3	116	**
- including the university component (CD UC)	16	12	17	11	14	6	2		64	
- including optional component (CD OC)	6	7		5	14	12	5	3	52	
<b>Cycle of majors (M)</b>				4	5	9	25	17	60	**
- including the university component (M UC)				4		4		5	13	
- including optional component (M OC)					5	5	25	12	47	
<i>Professional internship (PI)</i>				4		4		5	15	
<b>Additional types of training</b>										
<b>Final attestation (FA)</b>										
<b>TOTAL number of credits for the academic program</b>	32	28	31	29	28	32	32	28	240	*Not less than 8 cr. Not less than 240 cr.



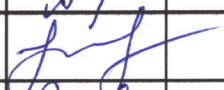
\*\*The cycle of core disciplines and majors (CD, M) is not less than 176 cr.

## 6. Additional educational programs (Minor)

The name of the additional educational program (Minor) with an indication of the list of disciplines that form Minor	Total number of credits / number of credits by discipline	Semesters of study	Documents following the results of the development of additional educational programs (Minor)
<b>Data protection</b>			
SEC6206 Cryptographic methods of information protection	5	5	Transcript
SEC6211 Protection of database management systems	5	6	Transcript
SEC6236 Protection of applications and scripts from modifications	5	7	Transcript
<b>Accounting by ACCA</b>			
ACC6701 Business Technology (ACCA)	5	5	Transcript
ACC6702 Financial Accounting	5	6	Transcript
ACC6703 Management Accounting	5	7	Transcript
<b>Management &amp; Leadership</b>			
MGT6701 Management	5	5	Transcript
MGT6707 Psychology of Management	5	6	Transcript
MGT6702 Organizational Behavior and Leadership	5	7	Transcript
<b>IoT Security Technologies</b>			
HRD6202 IoT Technologies	5	5	Transcript
SEC6215 IoT Security	5	6	Transcript
SEC6235 Biometric Access Control Systems	5	7	Transcript

**7. Approval sheet with developers**

Name of educational program: 6B06112 "Data Science"

№	Position, scientific or academic degree, name and surname of the developer of the educational program	Date	Signature	Note
1	Professor, Doctor of Physics and Mathematics Rysbaiuly B.			
2	Assistant professor, PhD Ydyrys A. Zh.			
3	Assistant professor, PhD Nurtas M.			
4	Senior-lecturer Alpar S.D.		