SATBAYEV UNIVERSITY

Institute _ Automation and information technology __
Department __ Software Engineering _____

EDUCATIONAL PROGRAM
7M06102 Machine Learning & Data Science
Code and name of educational program

Code and classification of the field of education: **7M06 "Information and communication technologies"**
Code and classification of training directions: **7M06 "Information and communication technologies"**
Group of educational programs: **M094 "Information technology"**
Level based on NQF: **7**
Level based on IQF: **7**
Study period: **2 years**
Amount of credits: **120**

Almaty 2024

Educational program 7M06102 Machine Learning & Data Science

code and name of educational program

was approved at the meeting of K.I. Satbayev KazNRTU Academic Council
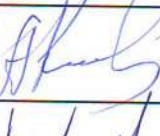
Minutes # 12 dated «_22___» __04____2024.

was reviewed and recommended for approval at the meeting of K.I. Satbayev KazNRTU Educational and Methodological Council
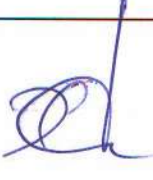
Minutes # 6 dated «_19_» _04__2024.

Educational program _7M06102 Machine Learning & Data Science_

code and name of educational program

was developed by Academic committee based on direction 7M061 «Information and communication technologies»

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List of abbreviations and designations

EP – educational program
BC – basic competencies
PC – professional competencies
LO – learning outcomes
MOOC – Massive Open Online Courses
NQF – National Qualifications Framework
IQF – Industry Qualifications Framework
ML – Machine learning
DS – Data science

1. Description of educational program

The main focus of the master's program is on an in-depth study of software development technologies in the field of artificial intelligence. The program is aimed at training a high-quality specialist in accordance with the level of competence, capable of independently conducting scientific research, independently conducting research and development in the field of Data Science and machine learning, working in a team, and navigating modern Information Technologies. The educational program is built taking into account current trends in the development of artificial intelligence and in close connection with the manufacturing sector.

The educational program was developed based on an analysis of the labor functions of software engineers, system administrators, and data analysts, as stated in professional standards. Representatives of Kazakh companies in the field of software product development participated in the development of the educational program. The program is aimed at the following areas of professional activity:
– Data analysis
– Machine learning
– Artificial intelligence

Contents of the educational program:
– General educational complex of disciplines
– Data analysis disciplines
– Machine learning disciplines
– Disciplines of artificial intelligence
– Disciplines of software development project management

The duration of master's studies is determined by the volume of completed academic credits. When mastering the established volume of academic credits and achieving the expected learning outcomes for obtaining a master's degree, the master's degree program is considered fully completed. In the scientific and pedagogical master's program there are at least 120 academic credits for the entire period of study, including all types of educational and scientific activities of the master's student.

Planning of the content of education, the method of organizing and conducting the educational process is carried out by the university and scientific organization independently on the basis of credit education technology.

The master's program in scientific and pedagogical direction implements educational programs of postgraduate education for the training of scientific and scientific-pedagogical personnel for universities and scientific organizations with in-depth scientific, pedagogical and research training.

The content of the master's educational program consists of:
1) theoretical training, including the study of cycles of basic and major disciplines;
2) practical training of undergraduates: various types of internships, scientific or professional internships;

3) research work, including the completion of a master's thesis, for scientific and pedagogical master's programs
4) final certification.

2. Purpose and objectives of educational program

Purpose of EP: To provide practice-oriented training for research and production specialists in the development of software products in the field of data analysis, machine learning and artificial intelligence.

Tasks of EP:
- Prepare specialists in engineering, scientific activities and production for production and technological activities related to the process of developing algorithms for machine learning and data analysis, focused on meeting the expectations and requirements of users, for organizational and management activities related to the process of supporting better management decisions at different levels of management , information systems management.
- Carry out scientific and pedagogical activities, participate in the development of educational and methodological materials for teaching disciplines in colleges and universities in the field of Information and Communication Technologies.
- Create conditions for continuous professional self-improvement, development of social and personal competencies, social mobility and competitiveness in the labor market.
- Select modern technologies in the field of artificial intelligence for training scientific personnel.
- Teach undergraduates to develop machine learning algorithms and algorithms for solving various problems based on analysis of the subject area.

3. Requirements for evaluating the educational program learning outcomes

The educational program was developed in accordance with the State Compulsory Standards of Higher and Postgraduate Education, approved by order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022 No. 2 (registered in the Register of State Registration of Normative Legal Acts under No. 28916) and reflects the learning results, based on which develop curricula (working curricula, individual curricula for students) and working curricula for disciplines (syllabuses). Mastering disciplines of at least 10% of the total credits of the educational program using MOOCs on the official platform https://polytechonline.kz/cabinet/login/index.php/, as well as by studying disciplines through the international educational platform Coursera

https://www.coursera.org/.

Assessment of learning outcomes is carried out based on developed tasks within the educational program in accordance with the requirements of the state compulsory standard of higher and postgraduate education.

When assessing learning outcomes, uniform conditions and equal opportunities are created for students to demonstrate the level of their knowledge, skills and abilities.

When conducting intermediate certification online, online proctoring is used.

4. Passport of educational program

4.1. General information

№	Field name	Comments
1	Code and classification of the field of education	7M06 «Information and communication technologies»
2	Code and classification of training directions	7M06 «Information and communication technologies»
3	Educational program group	M094 «Information technology»
4	Educational program name	7M06102 Machine Learning & Data Science
5	Short description of educational program	The main focus of the master's program is on an in-depth study of methods of machine learning, data analysis and software development technologies in the field of artificial intelligence. The program is aimed at training a high-quality specialist in accordance with the level of competence, capable of independently conducting scientific research, independently developing complex software solutions, working in a team, and navigating modern Information Technologies. The educational program is structured taking into account current trends in software development and in close connection with the manufacturing sector.
6	Purpose of EP	The aim of the educational program is to train masters of technical sciences with specialized competencies in the research and development of machine learning methods for collecting, analyzing and processing big data. To provide practice-oriented training for research and production specialists in the development of software products in the field of data analysis, machine learning and artificial intelligence. Create conditions for continuous professional self-improvement, development of social and personal competencies (broad cultural outlook, active citizenship, determination, organization, hard work, communication skills, ability to reason and make organizational and managerial decisions, mastery of modern information technologies, fluency in several languages, desire to self-development and commitment to ethical values and a healthy lifestyle, the ability to work in a team, responsibility for the final

		result of one's professional activities, civic responsibility, tolerance), social mobility and competitiveness in the labor market.
7	Type of EP	New
8	The level based on NQF	7
9	The level based on IQF	7
10	Distinctive features of EP	No
11	List of competencies of educational program	Requirements for key competencies of graduates of scientific and pedagogical master's programs must: 1) have an idea: - about the role of science and education in public life; - about modern trends in the development of scientific knowledge; - about current methodological and philosophical problems of natural (social, humanitarian, economic) sciences; - about the professional competence of a higher school teacher; - about the contradictions and socio-economic consequences of globalization processes. 2) know: - methodology of scientific knowledge; - principles and structure of the organization of scientific activity; - psychology of cognitive activity of undergraduates in the learning process; - psychological methods and means of increasing the effectiveness and quality of training. 3) be able to: - use the acquired knowledge for the original development and application of ideas in the context of scientific research; - critically analyze existing concepts, theories and approaches to the analysis of processes and phenomena; - integrate knowledge acquired within different disciplines to solve research problems in new unfamiliar conditions; - by integrating knowledge, make judgments and make decisions based on incomplete or limited information; - apply knowledge of pedagogy and psychology of higher education in their teaching activities; - apply interactive teaching methods; - - carry out information-analytical and information-bibliographic work using modern information technologies; - think creatively and creatively approach solving new problems and situations; - be fluent in a foreign language at a professional level, allowing you to conduct scientific research and teach special disciplines in universities; - summarize the results of research and analytical work in the form of a dissertation, scientific article, report, analytical note, etc. 4) have the skills: - research activities, solving standard scientific problems; - implementation of educational and pedagogical activities on credit technology of education; - methods of teaching professional disciplines;

		- use of modern information technologies in the educational process; - professional communication and intercultural communication; - oratory, correct and logical presentation of one's thoughts in oral and written form; - expanding and deepening the knowledge necessary for everyday professional activities and continuing education in doctoral studies. 5) be competent: - in the field of scientific research methodology; - in the field of scientific and scientific-pedagogical activities in higher educational institutions; - in matters of modern educational technologies; - in carrying out scientific projects and research in the professional field; - in ways to ensure constant updating of knowledge, expansion of professional skills and abilities.
12	Learning outcomes of educational program	**LO1:** Apply a foreign language at a professional level, which allows teaching basic disciplines in universities, reviewing literary sources, analyzing trends in modern science and identifying promising areas of scientific research. **LO2:** Apply the MapReduce programming model for scientific and scalable data processing. **LO3:** Plan and conduct seminars, practical, laboratory classes, taking into account the requirements of the developed and approved working curricula and guidelines, develop educational and methodological materials to accompany the educational process and implement innovations in the education and upbringing of students, apply the knowledge of pedagogy and psychology of higher education in their pedagogical and research activities. **LO4:** Apply the methods of statistical analysis and machine learning in relation to the tasks of processing various data, including structured, unstructured, scientific, genomic, etc., conduct scientific research, organize work on the collection, storage and processing of information, create analytical systems and recommender services based on machine learning and deep learning algorithms. **LO5:** Establish interpersonal and group communications; define your role in the team, set goals and formulate tasks related to its implementation; build interaction taking into account the social characteristics of team members; design and organize team work; determine the needs of team members in mastering new knowledge and skills. **LO6:** Integrate knowledge gained from different disciplines to solve research problems in new unfamiliar environments and generate new ideas in the context of scientific research in the area of artificial intelligence and data mining. **LO7:** Apply an approach based on numerical methods for solving optimization problems and linear programming to formalize and model real-world objects. **LO8:** Extract the necessary information from various sources, including real-time information flows, develop scientific, technical and innovative solutions for the enterprise information

		infrastructure, taking into account the possibilities of big data technologies, cloud computing models and information security principles. **LO9:** Apply the concepts of software design and development, business ecosystem modeling, virtual reality models, and real-time systems. **LO10:** Develop and implement deep learning models and train them on real datasets.
13	Education form	Full-time
14	Period of training	2 years
15	Amount of credits	120
16	Languages of instruction	Kazakh, Russian, English
17	Academic degree awarded	Master of Technical Sciences
18	Developer(s) and authors	Akhmediyarova A.T., Abdoldina F.N., Mukazhanov N.K.

Professional Standard for the EP

№	Name of professional standard	Date of approval of the PS
1	Professional standard: Teacher (faculty) of higher and (or) postgraduate education organizations	20.11.2023
2	Development of artificial intelligence applications	05.12.2022
3	Development of big data processing and storage systems	05.12.2022

4.2. Relationship between the achievability of the formed learning outcomes based on educational program and academic disciplines

№	Discipline name	Short description of discipline	Amount of credits	Generated learning outcomes (codes)									
				PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
	Cycle of basic disciplines **University component**												
1	Foreign language (professional)	The course is designed for undergraduates of technical specialties to improve and develop foreign language communication skills in the professional and academic field. The course introduces students to the general principles of professional and academic intercultural oral and written communication using modern pedagogical technologies (round table, debates, discussions, analysis of professionally oriented cases, design).	3	+									
2	Management Psychology	Purpose: to acquire skills in making strategic and managerial decisions, taking into account the psychological characteristics of the individual and the team. Content: the modern role and content of psychological aspects in management activities, methods for improving psychological literacy, the composition and structure of management activities, both at the local and foreign levels, the psychological feature of modern managers.	3					+					
3	History and philosophy of science	Purpose: to explore the history and philosophy of science as a system of concepts of global and Kazakh science. Content: the subject of philosophy of science, dynamics of science, the main stages of the historical development of science, features of classical science, non-classical and post-non-classical science, philosophy of mathematics, physics, engineering and technology, specifics of engineering sciences, ethics of science, social and moral responsibility of a scientist and engineer.	3			+			+				
4	Higher education pedagogy	Purpose: to learn how to solve scientific and pedagogical problems, taking into account new technologies in the field of higher education. Content: methodological and theoretical foundations of higher school pedagogy, modern pedagogical technologies, planning and organization of learning and upbringing processes, the use of communicative technologies of subject-subject interaction between a teacher and a student in the educational process of a university, human resource management in higher educational	3			+							

№	Discipline	Description	Credits											
		institutions.												
5	Teaching practice	Aimed at developing practical skills and teaching methods. Pedagogical practice can be carried out during the period of theoretical training without interruption from the educational process. At the same time, master's students can be involved in teaching classes at the bachelor's level.	8	+		+		+						
	Cycle of basic disciplines **Component of choice**													
6	System and network administration	The purpose of this course is to provide undergraduates with in-depth knowledge and practical skills in the administration of information systems and computer networks, taking into account modern requirements for reliability, security and operational efficiency. Contents: The course covers advanced operating system administration techniques (Windows, Linux), including in-depth study of configuration, monitoring and security. Master's students also learn complex aspects of computer network administration, including network architecture, device management, routing, segmentation, and security. The course also includes cloud technologies, virtualization and data backup techniques. Practical classes are aimed at solving real problems of administering systems and networks, as well as developing strategies to ensure the effective operation of the organization's information infrastructure.	5										+	
7	Cloud Technologies	The course will provide the competencies necessary to work with cloud systems with different settings. The content of the course examines the following issues: collection, visualization, storage of data, their security and automation; design and deployment of a cloud storage system; developing the most convenient and effective strategy for migrating legacy systems to the cloud; development of testing methods to evaluate the effectiveness of corporate cloud systems in order to draw up recommendations for their improvement.	5		+							+	+	
8	Intellectual property and research	The purpose of this course is to provide undergraduates with the knowledge and skills necessary to understand, protect and manage intellectual property (IP) in the context of scientific research and innovation. The course is aimed at training specialists who can effectively work with IP, protect the results of scientific research and apply them in practice.	5			+			+					
9	Transformer architectures in large language models	Goal: Study and understand the principles and methods of transformer architectures in large language models. The course content includes the basics of natural language	5		+								+	+

		processing (NLP) theory, the study of transformer architecture, including the attention mechanism, multi-layer representations and learning mechanisms. Modern language models such as BERT, GPT and their application in various NLP tasks are also discussed. Hands-on activities include learning and using experiments											
10	Computational Intelligence	Purpose of the course: studying methods and technologies in the field of computational intelligence for creating intelligent systems and solving complex problems. Contents: As part of the course, undergraduates study in depth the basic concepts of computational intelligence, including artificial intelligence, machine learning, deep learning, neural networks and evolutionary algorithms. They are also introduced to natural language processing techniques, computer vision, automatic planning, and other areas of artificial intelligence. The course includes both theoretical lectures and practical exercises, during which students experiment with various algorithms and technologies, develop and test intelligent systems to solve a variety of problems.	5					+			+	+
11	Sustainable development strategies	Purpose: To train graduate students in sustainable development strategies to achieve a balance between economic growth, social responsibility, and environmental protection. Content: Graduate students will study the concepts and principles of sustainable development, the development and implementation of sustainable development strategies, the evaluation of their effectiveness, and international standards and best practices. Cases and examples of successful sustainable development strategies are included.	5	+		+						
12	Advanced Python	The goal of the course is to master the fundamentals of object-oriented programming in Python with a focus on abstract base classes and developer tools for creating various libraries. Contents: Principles of object-oriented programming (OOP) in Python, working with abstract base classes, containers, algorithms and iterators for efficient data processing. Manipulations with file system and data formats (XML, JSON, YAML). Interacting with web services via RESTful API and working with endpoints.	5			+						+
13	Advanced R	The purpose of the course is to provide Master students with knowledge and skills in using the R programming language for data analysis, statistics and machine learning at a more advanced level. Contents: As part of the course, students learn advanced	5			+						

№	Discipline	Description	Credits										
		programming techniques in the R language, the functionality of the language, effective methods of working with data, visualizing and interpreting analysis results. The course also includes topics on parallel programming, optimizing code performance, and creating your own packages and functions. Students gain hands-on experience with R at a more advanced level, allowing them to apply it effectively to their projects and research.											
		Cycle of profile disciplines **University component**											
14	Methodology of scientific research and innovation	The purpose of mastering the course is to develop the skills of conducting research activities in the master's student. The content of the discipline includes issues of determining the direction of research; goals and objectives of the study; stages of writing a scientific publication, literature review; organization of a scientific experiment; directions of innovation activity; The role of scientific research in innovation.	5	+		+			+				
15	Artificial Intelligence and Machine Learning	The purpose of this course is to provide master's students with comprehensive knowledge and practical skills in the field of artificial intelligence (AI) and machine learning (ML). The course content covers the following topics: Introduction to Artificial Intelligence and Machine Learning, Machine Learning Algorithms, Deep Learning and Neural Networks, Data Collection and Processing, Model Evaluation and Improvement, Application of AI and ML in Various Domains, Tools and Libraries for AI and ML, ethics and social aspects of AI.	5			+			+				+
16	Information retrival and Information extaraction	The purpose of this course is to provide undergraduates with theoretical knowledge and practical skills in searching, filtering and extracting information from a variety of data sources. Contents: Study of methods and models for effective information retrieval in text, multimedia and structured data. Examines algorithms and techniques for automatically extracting structured data from various sources such as web pages, documents, images and videos	5								+		
17	Business data analysis systems	Goal: For the master's student to master the methods and tools of data analysis used in business, with an emphasis on identifying patterns and trends that are important for making business decisions. Contents: Study of various approaches to collecting, storing, processing and analyzing data in a business context. Review of modern business intelligence systems and tools, including BI platforms, data visualization tools, reporting systems, and machine learning tools for data analysis.	5			+		+					

18	IT project management	The main goal of the IT Project Management course is to provide undergraduates with the knowledge and skills necessary to effectively plan, implement and complete IT projects. Issues covered in the course: enterprise architecture and its management; concepts, methodologies and standards of corporate governance; information technology management methodologies and standards; trends and prospects for the development of information management. As a result of mastering the discipline, master's students will be able to apply management methodology in IT projects	5					+				
19	Business Intelligence	The course is aimed at developing in master's students a complex of theoretical knowledge and practical skills in using modern information tools of business analytics for business management. During practical classes, undergraduates master skills in working in the most popular business analytics platforms: Power BI, Qlik Sense, Tableau to support decision-making in marketing and business management; skills in conducting OLAP (online analytical processing) when solving analytical problems: exploratory analysis, data research, generating analytical reporting.	5				+					
20	Reserch Project	The purpose of this course is to teach undergraduates to conduct independent scientific research and work on scientific projects. Course content covers the following topics: Developing a research topic and questions, developing research methodology, collecting data, analyzing data, writing and presenting a research report, managing a research project, ethics and professional standards in research.	4						+			
21	Research practice	The undergraduate research practice is carried out with the aim of familiarizing himself with the latest theoretical, methodological and technological achievements of domestic and foreign science, modern methods of scientific research, processing and interpretation of experimental data	4	+	+		+		+			
Cycle of profile disciplines **Component of choice**												
22	Applied Machine Learning & Deep Learning	The main goal of the course is to provide undergraduates with deep theoretical knowledge and practical skills for developing, implementing and optimizing machine learning (ML) and deep learning (DL) models in solving real-life problems. The course is aimed at training specialists who can effectively apply modern ML and DL methods in various fields such as business, healthcare, finance and science.	5				+			+		+

		Course content: Learning the basics of machine learning; deep learning and neural networks; collection, processing and analysis of data; development and implementation of MO and GO models; evaluation and improvement of models; tools and platforms for developing ML and GO; application of MO and GO in various fields,												+	
23	Big Data processing and applications	The goal of the discipline is to master the principles and obtain practical skills in organizing and technologies for storing, transforming and analytical processing of big data. The discipline examines the theoretical and practical aspects of using big data technologies and developing applications for processing big data. The lecture course examines trends in the development of infrastructure solutions for processing and storing big data. Practical exercises cover the development of applications for processing big data.	5										+		
24	NLP Basics	The purpose of the course is to familiarize undergraduates with the basic principles and methods of text analysis by computers within the framework of natural language. Contents: Study of various algorithms and techniques for automatic understanding and processing of text, such as tokenization, lemmatization, parsing, sentiment detection, named entity extraction and machine translation. Practical assignments are aimed at developing and implementing NLP models to solve specific problems, such as sentiment analysis of texts, automatic information extraction and machine translation.	5												+
25	Computer vision and image processing	The purpose of the course is to master the basic methods and technologies of analysis and processing of images by computers within the framework of computer vision. Contents: Study of various algorithms and approaches to image processing, such as filtering, segmentation, object recognition, feature extraction and classification. The course also examines modern computer vision methods, including deep learning and convolutional neural networks, and their applications in medicine, robotics, industrial automation and other areas.	5												+
26	Ecosystem Modeling	The main goal of the course is to provide undergraduates with the knowledge and skills necessary to create, analyze and interpret ecosystem models. The content of the discipline includes ways to apply mathematical and computer models to understand the dynamics of ecosystems, predict their changes and support decisions in the field of natural resource management and environmental protection.	5										+		

№	Discipline	Description	Cr.										
27	Deep learning in NLP	The goal of the course is to provide undergraduates with knowledge of modern deep learning methods and technologies used in the field of natural language processing (NLP). Contents: Explore core deep learning concepts, including recurrent neural networks (RNNs), convolutional neural networks (CNNs), transformers, and generative adversarial networks (GANs). Explores the use of deep learning in various NLP tasks such as machine translation, sentiment analysis, meaning inference, and text generation. Gaining practical skills in developing and applying deep learning models in NLP using modern libraries and frameworks such as TensorFlow and PyTorch.	5										+
28	Reinforcement Learning	The goal of the course is to provide undergraduates with in-depth knowledge and practical skills in the field of reinforcement learning (RL). The course aims to train professionals capable of developing, implementing and optimizing RL algorithms to solve complex problems in various fields such as robotics, gaming, management and business. The Reinforcement Learning course covers the basics and advanced concepts of the field of machine learning, where an agent is trained to make decisions in some environment with the goal of maximizing some reward. Main topics included in the course: Basic Reinforcement Learning Methods, Markov Decision Process (MDP), Utility Functions and Strategies, Approximate Learning, Deep Reinforcement Learning, Multi-Agent Reinforcement Learning, etc.	5								+		+
29	Development of Intelligent Applications	The main goal of the discipline is to provide undergraduates with comprehensive knowledge and practical skills necessary to create, implement and optimize intelligent applications. This course provides knowledge on the application of the capabilities of artificial intelligence and data analysis in applications that represent intelligent solutions. Course topics: modern intelligent applications, Applications of machine learning and natural language processing in applications, Advanced machine learning methods, Development of intelligent agents, etc.	5				+					+	+
30	Generative AI	The goal of this course is to provide students with an understanding of generative artificial intelligence methods and technologies for generating new data in various fields. The Generative AI course covers the principles, algorithms, and applications of generative models in artificial intelligence. The course covers topics such as: Generative Adversarial Networks (GAN), Autoencoders and Representation Learning, Deep	5				+						

		Generative Models, Text Generation and Natural Language Processing (NLP), Image Generation, Music Generation and Creative Artificial Intelligence, Ethical and Social Implications, etc.										
		Master's student's research work										
31	Master's student's research work, including internship and master's thesis	Systematization of theoretical knowledge, development of skills in setting problems on the research topic and solving them consistently. Research work includes assessing the objects of research, describing its problems, identifying a narrow area for research work, conducting an experiment, analyzing the results of the experimental part, preparing and defending a research report and summing up the results.	24				+		+	+	+		+

5. Curriculum of educational program

KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after K.I.SATBAYEV

SATBAYEV UNIVERSITY

APPROVED
Chairman of the Management Board-
Rector of Kazntu named after K.Satpayev
M.M. Begentaev
2024 y.

CURRICULUM
of Educational Program on enrollment for 2024-2025 academic year

Educational program 7M06102 - "Machine Learning & Data Science"
Group of educational programs M094 - "Information technology"

Form of study: full-time			Duration of study: 2 year				Academic degree: Master of Engineering Science				
Discipline code	Name of disciplines	Cycle	Total amount in credits	Total hours	Classroom amount lec/lab/pr	SIS (including TSIS) in hours	Form of control	Allocation of face-to-face training based on			
								I course		2 course	
								1 semester	2 semester	3 semester	4 semester
	CYCLE OF BASIC DISCIPLINES (BD)										
	M-1. Module of basic training (university component)										
LNG210	English (professional)	BD, UC	3	90	0/0/2	60	E	3			
HUM214	Management Psychology	BD, UC	3	90	1/0/1	60	E	3			
HUM212	History and philosophy of science	BD, UC	3	90	1/0/1	60	E		3		
HUM213	Higher school pedagogy	BD, UC	3	90	1/0/1	60	E		3		
	component of choice										
ICT212	System and network administration				1/0/2						
CSE795	Cloud Technologies	BD CCH	5	150		105	E	5			
MNG781	Intellectual property and research				2/0/1						
ICT203	Transformer architectures in large language models										
CSE798	Computational Intelligence	BD CCH	5	150	2/0/1	105	E			5	
MNG782	Sustainable development strategies										
ICT214	Advanced Python	BD CCH	5	150	2/1/0	105	E	5			
ICT213	Advanced R				2/0/1						
	CYCLE OF PROFILE DISCIPLINES (PD)										
	M-2. Module of professional activity (university component, component of choice)										
CSE770	Methodology of scientific research and innovation	PD UC	5	150	2/0/1	105	E	5			
CSE784	Artificial Intelligence and Machine Learning	PD UC	5	150	2/0/1	105	E	5			
CSE785	Information retrival and Information extaraction	PD UC	5	150	2/0/1	105	E		5		
CSE786	Business data analysis systems	PD UC	5	150	2/0/1	105	E		5		
CSE799	IT project management	PD UC	5	150	2/0/1	105	E		5		
CSE284	Applied Machine Learning & Deep Learning										
CSE787	Big Data processing and applications	PD CCH	5	150	2/0/1	105	E		5		
CSE788	NLP Basics										
CSE789	Computer vision and image processing										
CSE706	Ecosystem Modeling	PD CCH	5	150	2/0/1	105	E			5	
CSE790	Deep learning in NLP										
CSE792	Reinforcement Learning										
CSE791	Development of Intelligent Applications	PD CCH	5	150	2/0/1	105	E			5	
CSE793	Generative AI										
SEC232	Business Intelligence	PD UC	5	150	2/0/1	105	E				5
CSE794	Reserch Project	PD UC	4	120	2/0/1	75	E			4	
	M-3. Practice-oriented module										
AAP229	Pedagogical practice	BD, UC	8							8	
AAP256	Research practice	PD, UC	4								4
	M-4. Experimental research module										
AAP268	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	4					4			
AAP268	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	4						4		
AAP251	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	2							2	
AAP255	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	14								14
	M-5. Module of final attestation										
ECA212	Preparation and defense of a master's thesis	FA	8								8
	Total based on UNIVERSITY:							30	30	29	31
								60		60	

	Hong Kong City University, Hong Kong, a Special Administrative. Region (SAR) of the People's Republic of China											
CS5187	Group 2. CS5187 Vision and Image	MR Elective	3								3	
CS6535	Group 1. CS6535 Guided Study in Artificial Intelligence	MR Elective	3								3	
CS5222	CS5222 Computer Networks and Internets	MR Core	3								3	
CS5351	CS5351 Software Engineering	MR Core	3								3	
CS5481	CS5481 Data Engineering	MR Core	3								3	
CS6520	Group 1. CS6520 Project	MR Elective	6									6
CS6491	Group 2. CS6491 Topics in Optimization and its Applications in Computer Science	MR Elective	3									3
CS6493	Group 1. CS6493 Natural Language Processing	MR Elective	3									3
CS5489	Group 1. CS5489 Machine Learning: Algorithms and Applications	MR Elective	3									3
CS5491	Group 2. CS5491 Artificial Intelligence	MR Elective	3								0	3
	Итого по УНИВЕРСИТЕТУ:									0	0	15	18
											0	33	

Примечание:

Major requirement Core	MR Core
Major requirement Elective	MR Elective

	Number of credits for the entire period of study				
	Cycles of disciplines		Credits		
Cycle code			university component (UC)	component of choice (CCH)	Total
BD	Cycle of basic disciplines		20	15	35
PD	Cycle of profile disciplines		38	15	53
		Total for theoretical training:	*0*	*58*	*30*	*88*
	RWMS		24		24
FA	Final attestation		8		8
		TOTAL:	8	82	30	120

Decision of the Academic Council of Kazntu named after K.Satpayev. Protocol № 2 от "22" 04 2024 y.

Decision of the Educational and Methodological Council of Kazntu named after K.Satpayev. Protocol № 6 от "19" 04 2024 y.

Decision of the Academic Council of the Institute of Automation and Information Technology. Protocol № 8 от "19" 04 2024 y.

Vice-Rector for Academic Affairs		Uskenbayeva R.K.
Acting Director of the Institute of A&IT		Kalpeeva Zh.B.
Head of the Department of Software Engineering		Abdoldina F.N.
Specialty Council representative from employers, President of the Association of Innovative Companies of the SEZ "PIT", Ph.D.		Konysbayev A.T.

6. Additional educational programs (Minor)

Name of additional educational programs (Minor) with disciplines	Total number of credits	Recommended semesters of study	Documents on the results of mastering the additional educational programs (Minor)