NON-COMMERCIAL JOINT-STOCK COMPANY "KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY NAMED AFTER K.I. SATBAYEV"

Institute of Information and Telecommunication Technologies
Department of Electronics, Telecommunications and Space Technologies

Educational program
7M07138 "Space equipment and technologies"

Code and classification of the field of education: 7M07 Engineering, manufacturing and construction industries
Code and classification of training areas: 7M071 Engineering and engineering
Group of educational programs: M107 Space Engineering
NRC level: 7
ORK level: 7
Duration of study: 2 years
Amount of credits: 120 credits

Almaty 2025

NON-COMMERCIAL JOINT-STOCK COMPANY "KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY NAMED AFTER K.I. SATBAYEV"

Educational program7M07138 - "Space equipment and technologies"approved at a meeting of the Academic Council of KazNITU named after K.I. Satpayev.

Protocol No. 10 dated "06" March 2025

Reviewed and recommended for approval at a meeting of the Educational and Methodological Council of KazNITU named after K.I. Satpayev.

Protocol No. 4 dated December 20, 2024

Educational program 7M07138 - "Space equipment and technologies"developed by the academic committee in the direction M107 - "Space Engineering"

Name	Academic degree / academic title	Position	Place of work	Signature
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		7M07138 – *Space Engineering and Technology*		

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List of abbreviations and designations

OP Educational program
PP Pedagogical practice
IP Research Practice
PPP Application Program Package

1 Description of the educational program:

The professional activities of the program's graduates cover the field of space engineering, in particular, space systems for remote sensing of the Earth (SS ERS) and aerospace monitoring.

Upon successful completion of the full course of study for the Master's degree, the graduate is awarded the academic degree of "Master of Engineering Sciences" in the field of space systems for remote sensing of the Earth.

The educational program of the master's degree 7M07138 - "Space Engineering and Technology" differs from the previous educational program in the specialty 6M074600 - "Space Engineering and Technology" by a complete update of the content of disciplines. The new program provides for specialization in the most popular areas of space engineering in the domestic economy - space systems for remote sensing of the Earth (design, development of space systems for remote sensing of the Earth, work with geospatial data). This is due to the need for in-depth study of these highly specialized areas.

At the bachelor's level, the OP "Space Engineering and Technology" provides for the formation of competencies in a broader area: development of spacecraft, ballistics, elements of space electronics, antenna-feeder devices. This is necessary for the formation of basic skills and preparation of graduates for the requirements of the master's degree.

At the master's level, further deepening of these competencies is envisaged.

The objectives of the educational program are as follows:

– study of a cycle of general educational disciplines with the aim of forming social and humanitarian training based on the laws of social and economic development of society, history, state, Russian and foreign languages, as well as modern information technologies;

– study of a cycle of basic disciplines for the development of natural scientific, technical and economic knowledge as the basis for professional education;

– mastering a cycle of core disciplines to develop theoretical knowledge and practical skills in managing processes in engineering telecommunications and infocommunication systems;

– acquisition of skills in performing technical calculations and substantiating design solutions using modern computer and intelligent software;

– study of disciplines that develop knowledge and skills in planning and organizing theoretical and laboratory research;

– familiarization with technical processes, systems of organization, planning and management of production, pedagogical activities and research methods during the course of research and pedagogical practices.

Types of work activities for graduates include work at enterprises in the aerospace and telecommunications industries, educational organizations and other facilities where technological systems and technical means of the Earth remote sensing system are used, ensuring monitoring, analysis and application of Earth remote sensing data and ensuring the smooth operation of the Earth remote sensing system technical facilities.

The objects of professional activity are the fields of science and technology, including a set of technologies, means, methods and approaches aimed at ensuring and developing applied tasks of the aerospace industry.

The duration of study in the Master's program is determined by the volume of academic credits acquired. Provided that the established number of credits is acquired and the planned learning outcomes are achieved, the Master's program is considered fully completed. In the scientific and pedagogical Master's program, the volume is at least 120 academic credits, including all types of educational and scientific activities.

Planning of the educational content, organization and implementation of the educational process are carried out by the university and scientific organization independently on the basis of credit technology of education.

The Master's degree program in scientific and pedagogical studies implements postgraduate education programs aimed at training scientific and scientific-pedagogical personnel for higher education institutions and research institutes with in-depth scientific and pedagogical training.

The content of the Master's degree program includes:

1. theoretical training (basic and core disciplines);
2. practical training of master's students (various types of practical training, scientific and professional internships);
3. research work, including the completion of a master's thesis (for scientific and pedagogical master's programs);
4. final certification.

The content of the educational program "Engineering Telecommunications and Intelligent Infocommunication Systems" is implemented in accordance with the credit technology of education and is carried out in the state and Russian languages.

2 The purpose and objectives of the educational program

The aim of the educational program is to prepare highly qualified master's students based on the integration of education and science of an effective system for training scientific, scientific and pedagogical personnel of a new formation, capable of solving issues of improving society, science and developing new technologies in space engineering.

For this purpose, the student undergoes a course of theoretical training and carries out significant relevance and practical significance. The results of the study are presented in the form of a master's thesis, the defense of which occurs in the established order

The objectives of the educational program are:

– study of a cycle of general educational disciplines to ensure social and humanitarian education based on the laws of social and economic development of society, history, state language, Russian and foreign languages, modern information technologies;

– study of a cycle of basic disciplines to obtain natural science, general technical and economic knowledge as the foundation of professional education.

– study of a cycle of specialized disciplines for the formation of theoretical knowledge, practical skills and abilities in use for the management and development of

processes of remote sensing systems, satellite navigation systems and satellite communication systems.

– acquisition of skills and abilities in performing technological calculations and substantiating design decisions using modern computer technologies and AI.

– study of disciplines that develop knowledge, skills and abilities in planning and organizing theoretical and laboratory research.

– familiarization with technological processes, systems of organization, planning and production management during various types of practice.

3 Requirements for the assessment of learning outcomes of the educational program

The applicants' previous level of education is higher professional education (bachelor's degree). The applicant must have a diploma of the established form and confirm the level of knowledge of English with a certificate or diplomas of the established form.

The procedure for admitting citizens to a master's degree program is established in accordance with the "Standard Rules for Admission to Study in Educational Organizations Implementing Postgraduate Educational Programs."

The formation of the contingent of master's students is carried out by placing a state educational order for the training of scientific and teaching staff, as well as payment for training at the expense of citizens' own funds and other sources. The state ensures that citizens of the Republic of Kazakhstan are granted the right to receive, on a competitive basis in accordance with the state educational order, free postgraduate education if they are receiving education at this level for the first time.

At the "entrance", a master's student must have all the prerequisites necessary for mastering the corresponding master's educational program. The list of necessary prerequisites is determined by the higher education institution independently.

In the absence of the necessary prerequisites, a master's student is allowed to master them on a fee-paying basis.

Degree awarded/qualifications: A graduate of this educational program is awarded the academic degree of "Master of Engineering Sciences".

A graduate who has completed a Master's degree program must have the following general professional competencies:

– the ability to independently acquire, comprehend, structure and use new knowledge and skills in professional activities, and develop one’s innovative abilities;

– the ability to independently formulate research goals and establish a sequence for solving professional problems;

– the ability to apply in practice knowledge of fundamental and applied sections of disciplines that determine the focus (profile) of the master's program;

– the ability to professionally select and creatively use modern scientific and technical equipment to solve scientific and practical problems;

– the ability to critically analyze, present, defend, discuss and disseminate the results of their professional activities;

– possession of skills in compiling and formatting scientific and technical documentation, scientific reports, reviews, reports and articles;

– readiness to lead a team in the area of their professional activity, tolerantly perceiving social, ethnic, religious and cultural differences;

– readiness to communicate orally and in writing in a foreign language to solve professional problems.

A graduate who has completed a master's degree program must have professional competencies corresponding to the types of professional activities that the master's degree program is focused on:

research activities:

– the ability to formulate diagnostic solutions to professional problems by integrating fundamental sections of science and specialized knowledge obtained during the master's program;

– ability to independently

– conduct scientific experiments and research in the professional field, generalize and analyze experimental information, draw conclusions, formulate findings and recommendations;

– the ability to create and explore models of objects under study based on the use of in-depth theoretical and practical knowledge in the fieldaerospace engineering.

– *scientific and production activities:*

– the ability to independently carry out production and scientific-production field, laboratory and interpretation work in solving practical problems;

– the ability to professionally operate modern field and laboratory equipment and devices in the field of the master's program;

– the ability to use modern methods of processing and interpreting complex information to solve production problems;

– *project activities:*

– the ability to independently draw up and present projects for research and development and scientific production work;

– readiness to design complex research and development and scientific production work when solving professional problems;

– *scientific and pedagogical activity:*

– the ability to conduct seminars, laboratory and practical classes;

– the ability to participate in the management of scientific and educational work of students in the fieldaerospace engineering. When developing a master's program, all general cultural and general professional competencies, as well as professional competencies related to the types of professional activity that the master's program is focused on, are included in the set of required results for mastering the master's program.

4 PASSPORT OF THE EDUCATIONAL PROGRAM

4.1 General information

No.	Field name	Note

1	Registration number	
2	Code and classification of the field of education	7M07 Engineering, manufacturing and construction industries
3	Code and classification of training areas	7M071 Engineering and engineering
4	Group of educational programs	M107 Space Engineering
5	Name of the educational program	7M07138 "Space equipment and technologies"
6	Type of OP	New OP
7	Purpose of the OP	Providing master's students with fundamental and advanced specialized training in modern areas of Earth remote sensing (ERS) space systems, space technology, and engineering, aimed at developing analytical and professional competencies necessary for research and managerial activities in the specified field
8	Brief description of the educational program	The educational program 7M07138 "Space Engineering and Technology" provides training for highly qualified specialists in the field of space technologies, Earth Remote Sensing and satellite navigation.
9	Level according to NRC	Level 7 – Higher education and practical experience
10	Level according to ORK	Level 7 – A wide range of specialized (theoretical and practical) knowledge (including innovative). Independent search, analysis and evaluation of professional information
11	Distinctive features of the OP	No
12	Learning outcomes for the educational program	PO1. Analyze scientific and technical problems of conceptual development of the space industry, in particular space systems for remote sensing of the Earth, satellite communication systems and navigation systems. PO2. Analyze and forecast the development of technical systems, teach and conduct scientific research, plan and set research tasks, develop and design remote sensing systems. PO3. Possess skills in applying theoretical knowledge of space systems for remote sensing of the Earth and the ability to implement new ideas and plan, conduct scientific experiments for applied tasks of the space industry. PO4. Analyze the methods of theoretical and approaches to practical knowledge in the field of space technology and technology, automation systems and robotics of space systems. PO5. Demonstrate your intellectual level based on knowledge of the philosophy of science, higher education pedagogy, foreign languages and management psychology. Constantly acquire new knowledge and skills and systematically expand your worldview. PO6. Demonstrate the ability to apply theoretical and practical skills in interpreting space images and their applications to production tasks and conduct research to improve the quality characteristics of images. PO7. Demonstrate theoretical and practical knowledge in the field of modern pedagogical methods of teaching in higher education institutions and secondary specialized educational institutions.

13	Form of study	Full-time
14	Duration of study	2 years
15	Language of instruction	Kazakh/Russian
16	Volume of loans	120 credits
17	Awarded academic degree	Master of Engineering Sciences
18	Availability of an appendix to the license for the direction of personnel training	AB№0137395
19	Developer(s) and authors:	Tashtai E., Zhunusov K.Kh., Khabay A

4.2. The relationship between the attainability of the learning outcomes formed under the educational program and academic disciplines

No.	Name of the discipline	Brief description of the discipline	Number of credits	Formed learning outcomes (codes)									
				RO1	PO2	PO3	PO4	RO5	RO6	RO7	RO8	RO9	RO10
Cycle of basic disciplines university component													
1	English language (professional)	The course is designed for master's degree students in technical specialties to improve and develop foreign language communication skills in the professional and academic sphere. 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). History and philosophy of scienceThe course ends with a final exam. Master's students are also required to study independently (MIS).	5	**V**									
2	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										
3	Higher school pedagogy	The course is aimed at mastering the methodological and theoretical foundations of higher education pedagogy. The discipline will help to master the skills of modern pedagogical technologies, technologies of pedagogical design, organization and control in higher education, skills of communicative competence. At the end of the course, undergraduates learn how to organize and conduct various forms of organizing training, apply active teaching methods, and select the content of training sessions. Organize the educational process on the basis of credit technology of education.	3										

4	Psychology of management	The course is aimed at mastering the tools for effective employee management, based on knowledge of the psychological mechanisms of the manager's activity. Discipline will help you master the skills of making decisions, creating a favorable psychological climate, motivating employees, setting goals, building a team and communicating with employees. At the end of the course, undergraduates will learn how to resolve managerial conflicts, create their own image, analyze situations in the field of managerial activity, as well as negotiate, be stress-resistant and effective leaders.	3										
	Cycle of basic disciplines, optional components												
5	Digital wireless networks	A study of the methods for design, development and an upgrade of wireless networks and systems, as well as the skills of installation in the practical implementation of the new technologies in the existing networks	5										
6	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										
7	Computer vision	Computer vision is the study of creating computer systems that have a general high-level understanding of digital images or video and are designed to detect, track and classify objects. From a practical standpoint, computer vision seeks to understand and automate the tasks that the human visual system can perform. This course focuses on the study of end-to-end models for image classification problems.	5										
8	Organization of research and development	Subject of scientific activity, object of scientific activity, empirical methods of scientific cognition, analogy, relevance of the topic, aspect, hypotheses of research, features of the scientific method of cognition, method of deduction, method of induction, classification of science and scientific research, theory of experimental planning, analytical review, modern sources of publication, rules for compiling research and development reports	5										

9	Spacecraft Control Systems	The main topics of the course include general principles of spacecraft control, mathematical modeling of their motion, orientation and stabilization methods, as well as control and navigation algorithms. Special attention is given to hardware components, including onboard computing systems, sensors, actuators, and navigation systems. Additionally, issues of reliability, fault tolerance, and trajectory optimization, which are essential for the efficient operation of spacecraft, are considered. Furthermore, the course covers inclusive engineering and accessible technologies. Adaptive interfaces, voice-controlled and autonomous management systems for spacecraft control tailored for users with special needs are explored. The course also analyzes the potential applications of inclusive artificial intelligence and neural networks, as well as methods for designing accessible navigation systems for professionals with disabilities. All educational materials are provided in an accessible format, including subtitles, adaptive programs, and specialized modeling tools.	5											
10	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.												
11	Theory of solving inventive tasks in the space industry	The course "Theory of solving inventive problems in the space industry" covers the systems of laws of G.S. Altshuller, patterns and line of development of technical systems (TS), structural analysis and synthesis of TS (vepol analysis), the basics of ARIZ, ideal end result (ICR), techniques for resolving contradictions of TS, TRIZ standards, technological effects mathematical, physical and chemical, the theory of personality development and the theory of the development of creative teams and the role and place of TRIZ in the development of space technology.												

CYCLE OF PROFILING DISCIPLINES (PD)														
12	GIS Database and Database Management Systems	The course is aimed at studying geographic information systems and databases for space technologies. The course includes the theory and practice of designing, creating and managing GIS databases. Active learning methods include laboratory work, seminars and project assignments to consolidate knowledge and skills.	5											
13	Fundamentals of geoinformation systems in remote sensing	The course provides a broad overview of the problems of informatization and digitalization of society, the history of the development of geographic information systems, areas and levels of use of GIS remote sensing data, technologies for creating digital data based on remote sensing information. Analysis of the development of GIS remote sensing in various sectors of the economy. Development and implementation of GIS remote sensing using GPS. Software and hardware complexes of GIS systems ArcGIS, Mapinfo, GRASS, CityCom. ISO standards for GIS.	5											
14	Fundamentals of the organization of research in space technology and engineering	The objective of the course is to study the methods and principles of planning, conducting and analyzing scientific research in the field of space technology. The course covers the development of experimental setups, data analysis and interpretation of results. Active learning methods include laboratory work, research projects and seminars.	5											
15	Modern methods of space flight mechanics	The classical theory of orbital mechanics of space flights is analyzed based on Kepler's laws and Newtonian mechanics. This direction considers methods of orbit correction and control, including gravity maneuvers, trajectory optimization using ion and electric propulsion engines, and the use of aerodynamic brakes. Master's students master numerical methods and modeling tools, acquiring skills in orbital calculations. They study the solution of the N-body problem, numerical integration of motion, and the design of autonomous navigation systems for satellites. In addition, the application of artificial intelligence and machine learning algorithms in spacecraft control and flight trajectory optimization is considered.	5											
16	Deep learning for robots	The proposed course is devoted to the methods of "deep learning" - a new generation of neural network methods of machine learning, which caused	5											

		rapid development in a number of applied areas. The course is aimed at developing the skills of master's students in solving applied problems using deep neural networks. Over the past few years, deep learning methods have firmly established themselves in the applied areas of computer vision: visual pattern recognition, segmentation, color restoration using images, image description with tags, text processing, speech processing											
17	Dynamics and control of aerospace systems	Dynamics and Control of Aerospace Systems is a discipline aimed at studying the motion of aerospace vehicles, their stability and control methods. Within the course, master's students master the dynamics of orbital and atmospheric flight, equations of motion, analysis of linear and nonlinear control systems. Inertial navigation, autonomous control algorithms, adaptive and optimal control methods are also considered. This course is focused on ensuring the stability of the trajectory of spacecraft, performing maneuvers and responding to external influences. As a result of training, students acquire theoretical knowledge and practical skills necessary for effective control of the motion of aerospace systems.	5										
18	Fundamentals of optical and radar remote sensing systems	Synthesis of radar and optical images. Pre-processing calculation algorithm. Speckle noise filtering methods. Cloud marking. Image fusion methods. Joint processing algorithm at the point, object, and solution levels. Basics of visualization of extracted parameters.											
19	Prospective development of satellite navigation	This course is aimed at studying the principles of operation, structure and areas of application of satellite navigation systems. Students master the architecture and signal processing technologies of global navigation satellite systems (GNSS) - GPS, GLONASS, Galileo, BeiDou. The course examines methods of receiving, processing and analyzing navigation data, as well as integration with inertial navigation systems (INS). In addition, error correction algorithms, differential GPS (DGPS), RTK (Real-Time Kinematic) technology and the use of satellite navigation in various areas - transport, aviation, space, geodesy and others are studied. Upon completion of the course, students receive theoretical knowledge and practical skills in the field of design, analysis	5										

		and application of satellite navigation systems.											
20	Programming the microcontroller	The objective of the course is the technology of designing microelectronic systems based on microcontrollers and LSI (large-scale integrated circuits). Programming and debugging tools for microprocessor controllers. Practical circuits and program circuits for programming microcontrollers and FPGAs. When designing microcontrollers, it is necessary to maintain a compromise between size and cost on the one hand and flexibility and performance on the other. For different applications, the optimal ratio of these and other parameters can differ greatly.	5										
21	Project management	Objective: To gain knowledge about the components and methods of project management based on modern models and standards. Tasks: to study behavioral models of project-oriented business development management; to master international standards PMI PMBOK, IPMA ICB and national standards of the Republic of Kazakhstan in the field of project management; to analyze the features of organizational management of business development through the integration of strategic, project and operational management.	5										
22	Space-based remote sensing radar systems	The course on Space Remote Sensing Radar covers the following main sections: structure of the global aerospace monitoring system; information parameters of Space Remote Sensing Radar; tasks solved by radar; objects of radar observation and their properties; spectra of electromagnetic oscillations used by radar to observe the earth's surface from space; issues of radio signal polarization during transmission and reception; reflection of radio waves from various physical objects on Earth and their features; modern methods of space remote sensing radar; algorithms for synthesizing radar images in space-based synthetic aperture radars (SAR); methods for processing and recording radar images; ways to increase the information content of space-based SAR; state and prospects for the development of space-based remote sensing SAR.	5										
23	Satellite broadband communication	This course focuses on high-speed data transmission systems using satellite technologies. Students learn the architecture of satellite	5										

	systems	broadband communication systems, their operating principles, and areas of application. The course covers communication systems based on geostationary (GEO), medium-earth orbit (MEO), and low-earth orbit (LEO) satellites. It also covers multiple access methods (FDMA, TDMA, CDMA), signal transmission and modulation methods, data protection and error correction algorithms. The course also covers satellite Internet services, global communications infrastructure, and integration with 5G and IoT technologies. Upon completion of the course, students will gain theoretical and practical skills in designing, managing, and optimizing satellite broadband communication systems.											
24	Telemetric infocommunication systems	The purpose of studying the discipline is to build transmission systems with frequency division multiplexing (FDM). Methods of forming and transmitting channel signals in FDM transmission systems. Principles of building transmission systems with time division multiplexing (TDM). Hierarchical construction of PCM systems. Principles of building terrestrial and satellite television and sound broadcasting systems.	5										
25	Digital signal processing in space communications	Modulation methods, digital signal processing, satellite communication systems, quadrature-amplitude manipulation, development of noise-immune coding, analysis of adaptive algorithms for digital processing of space communication signals	5										
26	Electromagnetic compatibility of space and terrestrial systems	The objective is to master the principles of electromagnetic compatibility and develop skills in analyzing and designing communication systems. The course studies radio services and international radio frequency regulation. Key topics include EMC criteria and their application to various types of radio services, including satellite and terrestrial. Teaching methods include lectures, seminars, case studies, and practical exercises.	5										
27	Power supply for space and aircraft	The objective is to acquire knowledge of aviation power supply and develop skills in designing and maintaining systems. The course studies power supply systems and power supply reliability in aviation. Includes energy source analysis, remote power supply, and machine design of secondary power supply systems. Teaching methods include lectures, labs, case studies, and practical exercises.	8										

5 Working curriculum of the educational program

Duration of study: 2 years

NON-PROFIT JOINT STOCK COMPANY
"KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY NAMED AFTER K.I. SATBAYEV"

SATBAYEV UNIVERSITY

«APPROVED»
Decision of the Academic Council
NPJSC«KazNRTU
named after K.Satbayev»
dated 06.03.2025 Minutes № 10

WORKING CURRICULUM

Academic year	**2025-2026 (Spring, Autumn)**
Group of educational programs	**M107 - "Space engineering"**
Educational program	**7M07138 - "Space engineering and technologies"**
The awarded academic degree	**Master of Technical Sciences**
Form and duration of study	**full time (scientific and pedagogical track) - 2 years**

Discipline code	Name of disciplines	Block	Cycle	Total ECTS credits	Total hours	lek/lab/pr Contact hours	in hours SIS (including TSIS)	Form of control	Allocation of face-to-face training based on courses and semesters				Prerequisites
									1 course		2 course		
									1 sem	2 sem	3 sem	4 sem	
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)													
CYCLE OF BASIC DISCIPLINES (BD)													
M-1.Module of basic training (university component)													
HUM212	History and philosophy of science		BD, UC	3	90	15/0/15	60	E	3				
HUM213	Higher school pedagogy		BD, UC	3	90	15/0/15	60	E	3				
LNG213	Foreign language (professional)		BD, UC	3	90	0/0/30	60	E		3			
HUM214	Psychology of management		BD, CCH	3	90	15/0/15	60	E		3			
M-3.Module of professional activity (university component, component of choice)													
ELC233	Organization of research and development	1	BD, CCH	5	150	30/0/15	105	E		5			
MNG782	Sustainable development strategies	1	BD, CCH	5	150	30/0/15	105	E		5			
ELC734	Spacecraft Control Systems	1	BD, CCH	5	150	30/0/15	105	E		5			
CSE747	Computer vision	2	BD, CCH	5	150	30/0/15	105	E		5			
ELC295	Digital wireless networks	2	BD, CCH	5	150	30/0/15	105	E		5			
ELC282	Theory of solving inventive tasks in the space industry	1	BD, CCH	5	150	30/0/15	105	E			5		
MNG781	Intellectual property and research	1	BD, CCH	5	150	30/0/15	105	E			5		
M-4. Practice-oriented module													
AAP273	Pedagogical practice		BD, UC	8				R			8		
CYCLE OF PROFILE DISCIPLINES (PD)													
M-3.Module of professional activity (university component, component of choice)													
ELC283	Fundamentals of geoinformation systems in remote sensing		PD, CCH	5	150	30/0/15	105	E		5			
ELC730	Modern Methods of Space Flight Mechanics		PD, CCH	5	150	30/0/15	105	E		5			
M-4. Practice-oriented module													
AAP256	Research practice		PD, UC	4				R				4	
M-5 /Experimental research module													
AAP268	Research work of a master's student, including internship and completion of a master's thesis		RWMS	4				R	4				
AAP268	Research work of a master's student, including internship and completion of a master's thesis		RWMS	4				R		4			
AAP251	Research work of a master's student, including internship and completion of a master's thesis		RWMS	2				R			2		
AAP255	Research work of a master's student, including internship and completion of a master's thesis		RWMS	14				R				14	

M-6.Module of final attestation													
ECA212	Registration and protection of the master thesis		FA	8								8	
M-3. Module of Space Image Research													
ELC227	Fundamentals of optical and radar remote sensing systems	1	PD, CCH	5	150	30/0/15	105	E	5				
ELC733	Prospects for the Development of Satellite Navigation	1	PD, CCH	5	150	30/0/15	105	E	5				
ELC289	Digital signal processing in space communications	2	PD, CCH	5	150	30/0/15	105	E	5				
MNG705	Project Management	2	PD, CCH	5	150	30/0/15	105	E	5				
ELC213	Telemetry information and communication systems	3	PD, CCH	5	150	30/0/15	105	E	5				
ROB259	Deep learning for robots	3	PD, CCH	5	150	30/0/15	105	E	5				
ELC256	Programming the microcontroller	4	PD, CCH	5	150	30/15/0	105	E	5				ELC171
ELC731	Dynamics and Control of Aerospace Systems	4	PD, CCH	5	150	30/0/15	105	E	5				
ELC279	GIS database and database management systems		PD, UC	5	150	30/0/15	105	E			5		
ELC236	Fundamentals of organizing research into space technology and technology		PD, UC	5	150	30/0/15	105	E			5		
ELC277	Space-based remote sensing radar systems	1	PD, CCH	5	150	30/0/15	105	E			5		
ELC732	Satellite Broadband Communication Systems	1	PD, CCH	5	150	30/0/15	105	E			5		
ELC703	Electromagnetic compatibility of space and ground systems	1	PD, CCH	4	120	30/0/15	75	E				4	
ELC704	Power supply for space and aircraft	1	PD, CCH	4	120	30/0/15	75	E				4	
Total based on UNIVERSITY:									30	30	30	30	
									60		**60**		

Number of credits for the entire period of study

Cycle code	Cycles of disciplines	Credits			
		Required component (RC)	University component (UC)	Component of choice (CCH)	Total
GED	Cycle of general education disciplines	0	0	0	0
BD	Cycle of basic disciplines	0	17	18	35
PD	Cycle of profile disciplines	0	14	39	53
Total for theoretical training:		**0**	**31**	**57**	**88**
RWMS	Research Work of Master's Student				24
ERWMS	Experimental Research Work of Master's Student				0
FA	Final attestation				8
TOTAL:					**120**

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Minutes № 3 dated 20.12.2024

Decision of the Academic Council of the Institute. Minutes № 4 dated 22.11.2024

Signed:

Governing Board member - Vice-Rector for Academic Affairs — Uskenbayeva R. K.

Approved:

Vice Provost on academic development — Kalpeyeva Z. Б.

Head of Department - Department of Educational Program Management and Academic-Methodological Work — Zhumagaliyeva A. S.

acting Director of Institute - Institute of Automation and Information Technologies — Chinibayev Y. Г.

Department Chair - Electronics, telecommunications and space technologies — Tashtay Y. .

Representative of the Academic Committee from Employers ____Acknowledged____ — Dzhanikeyev M. S.