Mining and Metallurgical Institute named after O.A. Baikonurov
«Mine Surveying and Geodesy» department

EDUCATIONAL PROGRAM
8D07309 - « Geomatics, Geodesy and Geospatial Sciences »

Code and classification of the field of education: 8D07 Engineering, Manufacturing and Civil engineering
Code and classification of training areas: 8D073 Architecture and Civil engineering
Group of educational programs: D123 Geodesy
NRK Level: 8
ORC Level: 8
Duration of training: 3 years
Volume of credits: 180

Алматы 2024

NJSC "KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after K.I. SATPAYEV"

Educational program 8D07306 - «Geospatial digital Engineering» was approved at a meeting of the Academic Council of KazNRTU named after. K.I.Satpayev.
Protocol № 6 of 19.04.2024
Considered and recommended for approval at a meeting of the Educational and Methodological Council of KazNRTU named after. K.I.Satpayev.
Protocol № 12 of 22.04.2024

Educational program 8D07306 - «Geospatial digital Engineering» developed by the academic committee in the direction of «Geospatial digital Engineering»

Full name	Academic degree/ academic title	Position	Place of work	Signature
Chairman of the Academic Committee:				
Kochetova M.A.		director	«Leica Geosystems Kazakhstan»	
Academic staff:				
Orynbassarova E.O.	PhD	head of department	SU	
Kassymkanova Kh.M.	d.t.s	professor	SU	
Nukarbekova Zh.M.	m.s.c.	senior lecturer	SU	
Employer:				
Narbaev M.M.		director	TOO «ALIGeo»	
PhD student:				
Adebiet B.	m.s.c.	3rd year doctoral student		

F KazNRTU 703-05 Educational program

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List of abbreviations and designations

Table 1 – Abbreviations used

Reduction	Full name
ECTS	European Credit Transfer and Accumulation System
NJSC SU	NJSC Satbayev university
MES RK	Ministry of Education and Science of the Republic of Kazakhstan
TS	Teaching staff
EP	Educational program
RO	Registrar's Office
WC of the EP	Working curriculum of the EP

1. Description of the educational program

Training of scientific, technical and engineering personnel with world-class competencies in the field of digital technologies based on the integration of fundamental physical-mechanical and practice-oriented engineering education with research and development for geodesy, cartography, geoinformatics, land management and surveying.

2. The purpose and objectives of the educational program

Goal EP: creation, 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, economy, production, science and the development of new technologies in the field of geodesy, geospatial digital engineering.

Tasks EP:

Task 1: The readiness of specialists for research and project work in the field of geodesy, cartography, geoinformatics, including in related fields related to the selection of necessary research methods, modification of existing and development of new methods based on the objectives of a specific study.

Task 2: The readiness of specialists to develop and implement methods of technologies at the local level to solve problems in the field of geospatial technologies.

Task 3: The readiness of specialists to search for and obtain new information necessary to solve professional tasks in the field of knowledge integration in relation to their field of activity, to actively participate in the activities of an enterprise or organization.

Task 4: The readiness of specialists for scientific, informational, ideological and problematic communications in the professional environment and in the audience of non-specialists with a clear and deep justification of their position, to engage in organizational, managerial and service activities, to be aware of the responsibility for making their professional decisions.

Task 5: The readiness of specialists for self-study and continuous professional development.

Task 6: Willingness to analyze scientific publications and to present in writing the results of their own research in accordance with accepted norms in a foreign language.

Task 7: Willingness to navigate in modern approaches, methods and means of study, as well as trends and ways of developing methods for solving the problem.

3. Requirements for the evaluation of learning outcomes of the educational program

Learning outcomes include knowledge, skills and competencies and are defined both for the general education program and for its individual modules, disciplines or tasks.

The main task at this stage is to choose methods and means of evaluation for all types of control, with the help of which it is possible to effectively assess the achievement of the planned learning outcomes at the subject level.

4. Passport of the educational program

4.1. General information

№	Field name	Note
1	Field of education	8D07 Engineering, Manufacturing and Civil engineering
2	Direction of personnel training	8D073 Architecture and Civil engineering
3	Group of educational programs	D123 Geodesy
4	Educational program	8D07309 Geomatics, Geodesy and Geospatial Sciences
5	Brief description of the educational program	Training of scientific, technical and engineering personnel with world-class competencies in the field of digital technologies based on the integration of fundamental physical-mechanical and practice-oriented engineering education with research and development for geodesy, cartography, geoinformatics, land management and surveying.
6	EP purpose	Creation, 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, economy, production, science and the development of new technologies in the field of geodesy, geospatial digital engineering.
7	EP type	New EP
8	Level on NQF	8
9	Level on SQF	8
10	EP distinctive features	No
11	List of competencies of the educational program:	7
12	The formed educational outcomes	1.Analyze the trends of modern science, identify promising areas of scientific research in the subject area of professional activity, the composition of research papers, their determining factors. 2.Use methods of mathematical, numerical and computer modeling in the analysis and solution of applied and engineering problems, exhibiting the skills of expanding their knowledge based on information and educational technologies. 3.Gain in-depth knowledge in the subject area of professional activity, reflecting the current level of development. 4.To form a conceptual worldview of the future scientist in terms of studying the spatial aspects of the surrounding world when making professional and/or managerial decisions. 5.Use a mathematical and statistical approach to spatial problems, including methods from geoinformation systems and packages for statistical data processing. 6.To be guided by modern approaches, methods and means of studying the shape and external gravitational field of the Earth and other planets, as well as trends and ways of developing methods for solving this problem. 7.Analyze scientific publications and present in writing

		the results of their own research in accordance with accepted norms in a foreign language.
13	Form of training	Daytime
14	Duration of training	3 years
15	Volume of the credits	180
16	Languages of instruction	Russian, Kazakh
17	The awarded academic degree	Doctor
18	Developer(s) and authors:	Department of MSaG

4.2. The relationship between the achievability of the formed learning outcomes according to the educational program and academic disciplines

№	Name of the discipline	Brief description of the discipline	Number of credits	Generated learning outcomes (codes)							
				LR1	LR2	LR3	LR4	LR5	LR6	LR7	LR8
Cycle of basic disciplines University component											
1.	Academic writing	Content: fundamentals and general principles of academic writing, including: writing effective sentences and paragraphs, writing an abstract, introduction, conclusion, discussion, and references; in-text citation; preventing plagiarism; and preparing a conference presentation.	5				v			v	
2.	Methods of scientific research	Purpose: It consists in mastering knowledge about the laws, principles, concepts, terminology, content, specific features of the organization and management of scientific research using modern methods of scientometry. Contents: structure of technical sciences, application of general scientific, philosophical and special methods of scientific research, principles of organization of scientific research, methodological features of modern science, ways of development of science and scientific research, the role of technical sciences, computer science and engineering research in theory and practice.	5				v			v	

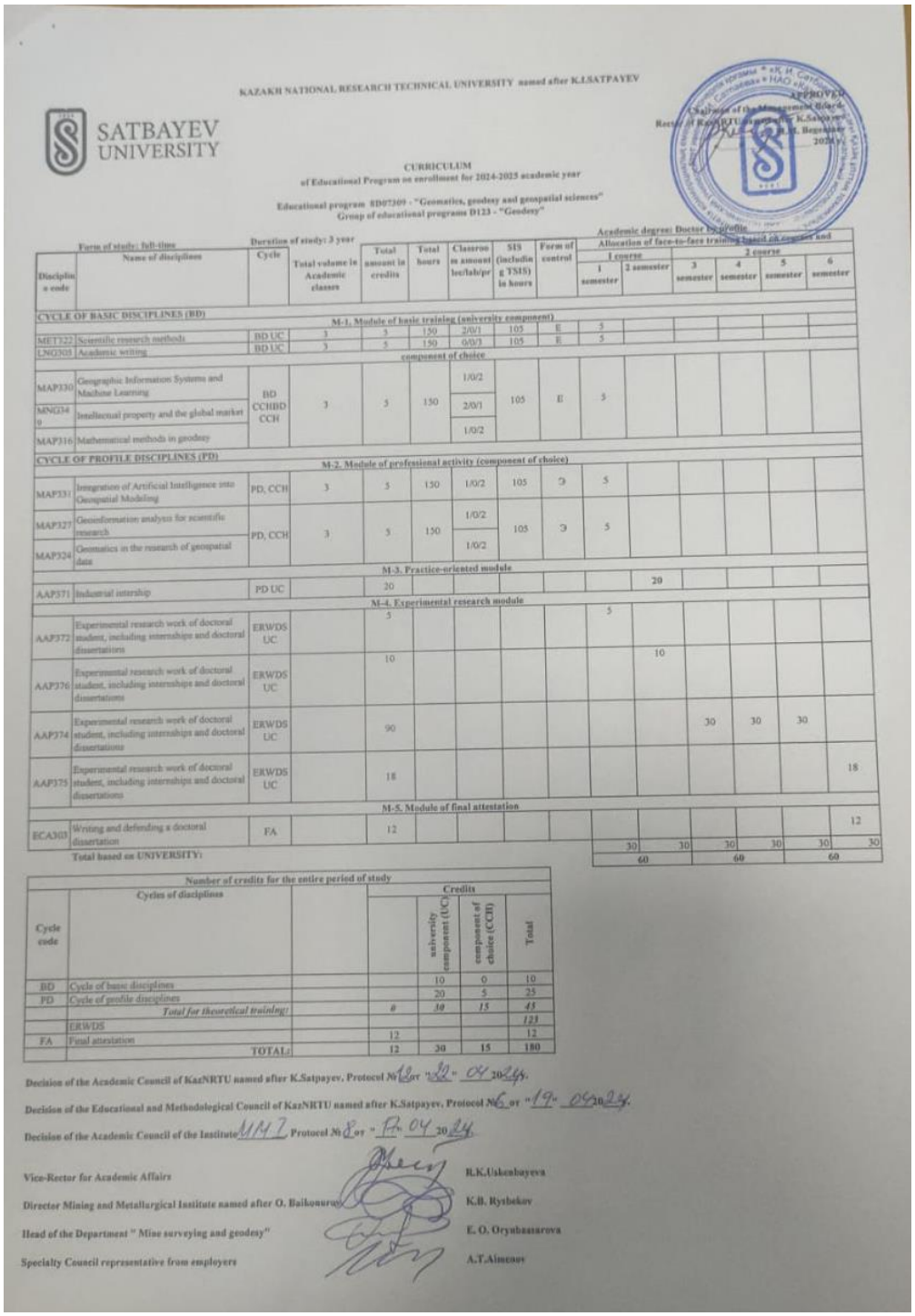
Cycle of basic disciplines Elective component											
1.	Mathematical methods in geodesy	Objective: Develop a profound understanding and skills in applying mathematical methods to solve problems in geodesy and geospatial sciences. Doctoral students will study essential mathematical techniques, including numerical methods, error theory, and linear and nonlinear optimization, used in geodetic calculations and spatial data analysis. The focus will be on applying these methods to solve scientific and applied challenges, such as precise coordinate determination, earth surface modeling, deformation analysis, and other engineering tasks, including geodetic work in construction. Students will also explore the software and computational technologies necessary for effective problem-solving.	5		**v**				**v**		
2.	Geographic Information Systems and Machine Learning	Objective: Master the methods and tools of geographic information systems (GIS) and machine learning for spatial data analysis and the resolution of applied problems in geodesy and geospatial sciences. Doctoral students will learn both basic and advanced GIS techniques, including data collection, processing, and visualization. They will also master machine learning algorithms applied to spatial data to automate and enhance analysis accuracy. The course	5	**v**			**v**				

		emphasizes practical applications of GIS and machine learning for scientific and practical issues in geodesy and geomatics, including terrain modeling, land use analysis, natural phenomenon forecasting, and infrastructure project optimization.									
3.	Intellectual property and the global market	The goal is to train specialists in the field of intellectual property law who can analyze and predict trends in its development in the global market, develop strategies for the protection and commercialization of intellectual property. Contents: global aspects of intellectual property and its role in international trade and economics, analysis of international agreements and conventions, IP management strategies, cases of protection and violation of intellectual property rights in various jurisdictions.	5					**v**	**v**		
Cycle of profile disciplines Elective component											
1.	Integration of Artificial Intelligence into Geospatial Modeling	Equip doctoral students to effectively use artificial intelligence (AI) methods to enhance accuracy and efficiency in geospatial modeling for scientific and applied research. Students will master fundamental and advanced AI techniques, such as neural networks, deep learning, image processing, and big data analytics, applied to geospatial research. The course will focus on the	5		**v**	**v**					

		practical use of AI for specific scientific and industrial problems, such as forecasting, automating geodetic surveys, improving spatial model quality, and developing intelligent decision support systems.									
2.	Geoinformation analysis for scientific research	Develop skills in applying geoinformatic analysis to solve scientific problems related to spatial data research and interpretation. Doctoral students will study methods of spatial analysis, geostatistics, spatial modeling, and data visualization, as well as their application to scientific and applied tasks. The course includes practical work with advanced GIS and spatial analysis software, aimed at studying earth processes, environmental monitoring, and resource management strategy development. PhD students will also learn methods for integrating spatial data with other information sources to create comprehensive models and maps.	5	**v**			**v**				
3.	Geomatics in the research of geospatial data	Develop skills in applying geomatics methods to analyze and interpret geospatial data with a focus on solving industrial problems. Doctoral students will study fundamental and advanced geomatics techniques, including remote sensing, GNSS technology, photogrammetry, and laser scanning, and their application in various fields. The emphasis will be on the scientific	5				**v**		**v**		

		and practical use of these methods to address real industrial problems, such as land resource management, infrastructure monitoring, urban planning, and environmental protection. PhD students will also master specialized software for processing and analyzing geospatial data.								

5. Curriculum of the educational program



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

SATBAYEV UNIVERSITY

APPROVED

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

Educational program 8D07309 - "Geomatics, geodesy and geospatial sciences"
Group of educational programs D123 - "Geodesy"

Form of study: full-time | Duration of study: 3 year | Academic degree: Doctor by profile

Discipline code	Name of disciplines	Cycle	Total volume in Academic classes	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 courses and semesters: 1 course 1 semester	1 course 2 semester	2 course 3 semester	2 course 4 semester	2 course 5 semester	2 course 6 semester
CYCLE OF BASIC DISCIPLINES (BD)														
M-1. Module of basic training (university component)														
MET322	Scientific research methods	BD UC	3	5	150	2/0/1	105	E	5					
LNG305	Academic writing	BD UC	3	5	150	0/0/3	105	E	5					
component of choice														
MAP330	Geographic Information Systems and Machine Learning	BD CCHBD CCH	3	5	150	1/0/2	105	E	5					
MNG349	Intellectual property and the global market					2/0/1								
MAP316	Mathematical methods in geodesy					1/0/2								
CYCLE OF PROFILE DISCIPLINES (PD)														
M-2. Module of professional activity (component of choice)														
MAP331	Integration of Artificial Intelligence into Geospatial Modeling	PD, CCH	3	5	150	1/0/2	105	Э	5					
MAP327	Geoinformation analysis for scientific research	PD, CCH	3	5	150	1/0/2	105	Э	5					
MAP324	Geomatics in the research of geospatial data					1/0/2								
M-3. Practice-oriented module														
AAP371	Industrial internship	PD UC		20						20				
M-4. Experimental research module														
AAP372	Experimental research work of doctoral student, including internships and doctoral dissertations	ERWDS UC		5					5					
AAP376	Experimental research work of doctoral student, including internships and doctoral dissertations	ERWDS UC		10						10				
AAP374	Experimental research work of doctoral student, including internships and doctoral dissertations	ERWDS UC		90							30	30	30	
AAP375	Experimental research work of doctoral student, including internships and doctoral dissertations	ERWDS UC		18										18
M-5. Module of final attestation														
ECA303	Writing and defending a doctoral dissertation	FA		12										12
Total based on UNIVERSITY:									30	30	30	30	30	30
									60		60		60	

Number of credits for the entire period of study

Cycle code	Cycles of disciplines	Credits: university component (UC)	component of choice (CCH)	Total
BD	Cycle of basic disciplines	10	0	10
PD	Cycle of profile disciplines	20	5	25
	Total for theoretical training:	*30*	*15*	*45*
	ERWDS			123
FA	Final attestation	12		12
	TOTAL:	12	30	15	180

Decision of the Academic Council of KazNRTU named after K.Satpayev, Protocol №12 от "22" 04 2024.

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

Decision of the Academic Council of the Institute MMG Protocol №8 от "Fr" 04 2024

Vice-Rector for Academic Affairs — R.K.Uskenbayeva

Director Mining and Metallurgical Institute named after O. Baikonurov — K.B. Rysbekov

Head of the Department " Mine surveying and geodesy" — E. O. Orynbassarova

Specialty Council representative from employers — A.T.Aimenov