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

EDUCATIONAL PROGRAM
8D07306 - «Geospatial digital Engineering»

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
Level based on NQF: 8
Level based on IQF: 8
Study period: 3 years
Amount of credits: 180

Алматы 2024

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
Academic staff:				
Orynbasarova E.O.	PhD	head of department	SU	
Aitkazinova Sh.K.	PhD	Associate Professor	SU	
Kenesbayeva A.	PhD	senior lecturer	SU	
Employer:				
Aymenov A.T.		Chief Engineer	Republican Cartographic Factory	
Student:				
Adilbekova L.K.	m.s.c.	1st year doctoral student		

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List of abbreviations and designations

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	Code and classification of the field of education	8D07 Engineering, Manufacturing and Civil engineering
2	Code and classification of training directions	8D073 Architecture and Civil engineering
3	Educational program group	D123 Geodesy
4	Educational program name	8D07306 Geospatial Digital Engineering
5	Short description of 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	Purpose of 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.
7	Type of EP	New EP
8	The level based on NQF	8
9	The level based on IQF	8
10	Distinctive features of EP	No
11	List of competencies of educational program	7
12	Learning outcomes of educational program	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	Education form	Full-time
14	Period of training	3 years
15	Amount of credits	180
16	Languages of instruction	Russian, Kazakh
17	Academic degree awarded	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	
2.	Methods of scientific research	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							
Cycle of basic disciplines Elective component											
1.	Mathematical methods in geodesy	Doctoral students will study essential mathematical techniques, including numerical methods, error theory, and linear and nonlinear optimization, used	5		v			v			

		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.									
2.	Mathematical modeling of deformation processes	Contents: Study of methods of correlation and regression analysis to establish trends in the dynamics of deformation processes; cellular automata to create predictive models of subsidence; forecasting of deformations of the Earth's surface, buildings and structures based on the results of geodetic observations using available quantitative and qualitative data of other types of field observations in Matlab software during research.	5		**v**			**v**			
3.	Intellectual property and the global market	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.	Geoinformation	Doctoral students will study methods of	5			**v**	**v**	**v**			

	analysis for scientific research	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.									
2.	Theory of the figure of the Earth	Contents: As part of the course, the doctoral student will master the possibilities of determining the figure of the Earth by successive approximations using heterogeneous geodetic, gravimetric, astronomical and satellite measurements: the concept of determining the figure of the Earth by its sequential refinement, as well as the relationship of parameters describing the figure and the external gravitational field of the Earth.	5								
3.	Fundamental and applied coordinate-time support of geodesy tasks	The discipline is focused on the formation of ideas and understandings about the main tasks and structure of the fundamental segment, the definition of the celestial and terrestrial reference coordinate systems, simplified models of the celestial and terrestrial systems, the modern level of solving the fundamental coordinate-time support,	5								

		the parameters of the datum, the requirements for a set of tools, the use of GNSS in coordinate-time support.									
Cycle of profile disciplines Practice-oriented model											
1.	Theory of the figure of the Earth	As part of the course, the doctoral student will master the possibilities of determining the figure of the Earth by successive approximations using heterogeneous geodetic, gravimetric, astronomical and satellite measurements: the concept of determining the figure of the Earth by its sequential refinement, as well as the relationship of parameters describing the figure and the external gravitational field of the Earth.	5			**v**			**v**		
2.	Fundamental and applied coordinate-time support of geodesy tasks	The discipline is focused on the formation of ideas and understandings about the main tasks and structure of the fundamental segment, the definition of the celestial and terrestrial reference coordinate systems, simplified models of the celestial and terrestrial systems, the modern level of solving the fundamental coordinate-time support, the parameters of the PVZ, the requirements for a set of tools, the use of GNSS in coordinate-time support.	5			**v**					

5. Curriculum of the educational program

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

SATBAYEV UNIVERSITY

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

CURRICULUM
of Educational Program on enrollment for 2024-2025 academic year
Educational program 8D07306- "Geospatial digital engineering"
Group of educational programs D123 - "Geogezly"

Form of study: full-time | Duration of study: 3 year | Academic degree: PhD

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 hours, courses and					
								I course		2 course			
								1 semester	2 semester	3 semester	4 semester	5 semester	6 semester
CYCLE OF BASIC DISCIPLINES (BD)													
M-1. Module of basic training (university component)													
MET322	Scientific research methods	BD UC	5	150	2/0/1	105	E	5					
LNG305	Academic writino	BD UC	5	150	0/0/3	105	E	5					
component of choice													
MAP328	Theory of the figure of the Earth	BD CCH	5	150	1/0/2	105	E	5					
MNG349	Intellectual property and the global market				2/0/1								
MAP329	Fundamental and applied coordinate-time support of geodesy tasks				1/0/2								
CYCLE OF PROFILE DISCIPLINES (PD)													
M-2. Module of professional activity (component of choice)													
MAP327	Geoinformation analysis for scientific research	PD, UC	5	150	1/0/2	105	E	5					
MAP326	Mathematical modeling of deformation processes	PD, CCH	5	150	1/0/2	105	E	5					
MAP316	Mathematical methods in geodesy				1/0/2								
M-3. Practice-oriented module													
AAP350	Pedagogical practice	BD UC	10						10				
AAP355	Research practice	PD UC	10							10			
M-4. Experimental research module													
AAP336	Research work of a doctoral candidate, including internships and completion of a doctoral dissertation	RWDS UC	5					5					
AAP347	Research work of a doctoral candidate, including internships and completion of a doctoral dissertation	RWDS UC	40						20	20			
AAP356	Research work of a doctoral candidate, including internships and completion of a doctoral dissertation	RWDS UC	60								30	30	
AAP348	Research work of a doctoral candidate, including internships and completion of a doctoral dissertation	RWDS 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		20	5	25
PD	Cycle of profile disciplines		10	10	20
	Total for theoretical training:	*0*	*30*	*15*	*45*
	RWDS				*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 MMI. Protocol № 8 от "17" 04 2024.

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

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

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

Specialty Council representative from employers — A.T.Aimenov