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

EDUCATIONAL PROGRAM
7M07306 - «Geospatial Digital Engineering»

Code and classification of the field of education: 7M07 Engineering Manufacturing and Civil engineering
Code and classification of training directions: 7M073 Architecture and Civil engineering
Group of educational programs: M123 Geodesy
Level based on NQF: 7
Level based on IQF: 7
Study period: 2 years
Amount of credits: 120

Almaty 2024

Educational program 7M07306 - «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 7M07306 - «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:				
Kenzhegulova A.E.		1st year master`s student		

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List of abbreviations and symbols

Abbreviation	Full name
ECTS	European Credit Transfer and Accumulation System
SU	NAO 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	Working curriculum of the EP

1. Description of the educational program

Designed for the implementation of scientific and pedagogical training of masters in the educational program "Geospatial Digital Engineering" at Satbayev University and developed within the framework of the direction "Geospatial Digital Engineering"

2. The purpose and objectives of the educational program

Goal EP: the purpose of the program is to train highly qualified scientific, technical and engineering personnel in the field of geodesy, geo informatics, geospatial digital technologies.

Tasks EP:

Task 1: The readiness of specialists for research and design work in the field of geodesy, cartography, geo informatics, mine surveying and land management, including in related areas related to the choice of the necessary research methods, modification of existing and development of new methods based on the objectives of a particular study.

Task 2: Readiness of specialists for production and technological activities that ensure the introduction of new digital developments at the local level

Task 3: The readiness of specialists to search and receive new information necessary to solve professional problems 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 a professional environment and in an 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-learning and continuous professional development during the entire period of scientific or advanced training during the entire period of scientific or professional activity.

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 educational program as a whole and for its individual modules, disciplines or tasks.

The main task at this stage is to select assessment methods and tools for all types of control, with the help of which it is possible to most effectively assess the achievement of planned learning outcomes at the discipline level.

4. Passport of the educational program

4.1 General information

№	Field name	Note
1	Code and classification of the field of education	7M07 Engineering, manufacturing and Civil engineering
2	Code and classification of training directions	7M073 Architecture and civil engineering
3	Educational program group	M123 Geodesy
4	Educational program name	7M07306 Geospatial Digital Engineering
5	Short description of educational program	It is intended for the implementation of scientific and pedagogical training of masters in the educational program "Geospatial Digital Engineering" at Satbayev University and was developed as part of the direction "Geospatial Digital Engineering"
6	Purpose of EP	The purpose of the program is to train highly qualified scientific, technical and engineering personnel in the field of geodesy, geo informatics, geo spatial digital technologies.
7	Type of EP	New EP
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	9
12	Learning outcomes of educational program	1. Be able to develop plans and programs for the organization of innovative activities at the enterprise and understand the economic efficiency using professional automated systems. Make optimal management decisions 2. Apply the skills of control systems, means of improving production efficiency and adapting modern information technologies to automate processes 3. Understand and apply the concepts of geospatial analysis, immersive technologies, and 3D visualization of aerospace and ground imaging techniques 4.To gain theoretical and practical skills, to carry out professional functions in the tasks of rational production of geodetic measurements, including substantiation of the type and type of geodetic instruments and equipment, their control in accordance with IOS standards 5. Conduct research and pedagogical work, improve the intellectual and general cultural level, improve the moral and physical development of one's personality in the competence of professional activity 6. Be able to analyze and apply modern computer technologies, including Web-based GIS for creating

		database management systems, analyzing mathematical processing methods, the ability to take creative initiative, prepare applications for inventions and industrial designs 7. Understand the trends in the development of digitalization technologies for geospatial data, to be ready to transform processes in the context of dynamic changes in processes in the production market, apply modern technologies to visualize and optimize production processes, manage big data in the field of geodesy and cartography 8. Apply the skills to express your thoughts fluently and clearly in English and use them as a means of business communication at a professional level 9. Master theoretical and practical skills in conducting geodetic surveys to solve applied and scientific problems
13	Education form	Full-time
14	Period of training	2 years
15	Amount of credits	120
16	Languages of instruction	Russian, Kazakh
17	Academic degree awarded	Master
18	Developer(s) and authors	Department MSaG

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

№	Name of the discipline	Brief description of the discipline	Number of credits	Formed learning outcomes (codes)								
				LR1	LR2	LR3	LR4	LR5	LR6	LR7	LR8	LR9
Cycle of basic disciplines University component												
1	Foreign language (professional)	The course is aimed at studying the main problems of scientific knowledge in the context of its historical development and philosophical understanding, the evolution of scientific theories, principles and methods of scientific research in the historical construction of scientific paintings of the world. The discipline will help to master the skills of developing critical and constructive scientific thinking based on research on the history and philosophy of science. At the end of the course, undergraduates will learn to analyze the ideological and methodological problems of science and engineering and technical activities in building Kazakhstan's science and the prospects for its development.	3								V	
2	History and philosophy of science	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,	3					V				

		physics, engineering and technology, specifics of engineering sciences, ethics of science, social and moral responsibility of a scientist and engineer.										
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					v				
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	3					v				

		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.										
Cycle of basic disciplines Selectable Component												
5	Innovative methods of engineering and geodetic works	As part of the course, the undergraduate will master the theoretical and practical use of innovative methods and technologies to solve scientific and applied problems. The main content of the course contains the following sections: GNSS, absolute and relative shooting methods (kinematics and statics), post-processing and real-time processing; UAVs and shooting methods; laser scanning and shooting methods (VLF, MLS, NLS) when performing engineering and survey, geodetic works.	5									v
6	Spatial Data Infrastructure	The study of the use of geodetic and cartographic methods in solving problems of creating databases of spatial and temporal data, environmental monitoring. The study of GIS packages, spatial data sources for solving professional tasks.	5							v		
7	Mathematical modeling of field indicators	The discipline studies the basic methods of mathematical modeling and their application in applied mining and geological sciences, the theory of mathematical modeling, which allows	5						v	v		

		you to build models of field indicators and judge their adequacy; scientific approaches to modeling field indicators; the basics of mathematical thinking, the use of mathematical language.										
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.										
9	Sustainable development strategies	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.										
10	Methods for the creation and development of state geodetic networks	As part of the course, the master's student will master methodological approaches to the development, creation, modernization and use of the state geodetic network; traditional and satellite methods for constructing a state geodetic network, methods for conducting geodetic measurements at	5				**v**					**v**

		GGS points, adjusting geodetic networks.										
11	Technology for automating the land survey process	The discipline "Technology for Automating the Land Research Process" includes the study of modern methods and tools for collecting, analyzing and interpreting data on land resources, optimizing land management and developing innovative approaches to the assessment and use of land plots.	5	v	v							
12	Aerospace environmental monitoring	The cartographic method is the study of the structure, interrelationships, dynamics and evolution of phenomena in time and space using maps, the forecast of their development, and obtaining all kinds of qualitative and quantitative characteristics.	5			v				v		
Cycle of major disciplines University component												
13	Big data in geosciences	As a result of studying the subject, the undergraduate must master the concept of using big data in geosciences; use the basic capabilities of the tool to load and visualize big data; apply intelligent big data processing technologies; ensure the security of big data.	5							v		
14	Organization of topographic and geodetic works	The main content of the discipline includes the following sections: planning of topographic and geodetic works, budgeting and calculation of costs for the organization and liquidation of works during geodetic	5		v							v

		surveys, organizational and legal forms of enterprises, fixed assets of the enterprise, labor productivity, the basics of labor rationing.										
15	Monitoring of deformation processes of buildings and structures	As a result of studying the subject, the undergraduate must master theoretical practical skills in measuring elevations of parts of buildings and structures; stress state in soil masses and structures of buildings and structures; horizontal movements of soil masses limited by slopes or slopes.	5				v					v
16	Visualization and processing of geospatial data	As a result of studying the subject, the undergraduate must master methods of processing and visual presentation of spatial data; interactive approaches to isosurface delineation for geovisualization; multivariate display and classification; interpretation of spatial analysis results; modeling of virtual environments (“True 3D”, empirical studies, VR/AR).	4			v				v		
17	Three-dimensional object modeling in GIS	The discipline "Three-dimensional modeling of objects in GIS" includes the study of methods for creating, analyzing and visualizing three-dimensional models of objects using geographic information systems. Discusses 3D modeling principles, tools and their applications in various fields such as urban planning, architecture and ecology.	5						v	v		
18	Spatial Analysis	The discipline "Spatial Analysis" includes the study of methods for	5						v			

		analyzing geographic data, visualization, statistics of spatial data, spatial modeling, the application of GIS in various fields and the acquisition of practical skills in working with software tools for analyzing spatial data.										
19	Organization of scientific research	The organization of scientific research based on the familiarization of undergraduates with scientific knowledge, the formation of readiness and ability to conduct research activities related to the selection of necessary research methods, conducting experimental research and analyzing their results, based on modern achievements of domestic and foreign scientists and opens the way to the introduction of new developments.	5					v				
20	Remote sensing of the Earth and natural resources	Formation of remote sensing data processing skills using modern software, classification and interpretation of the results obtained, correct design of the results and preparation of accounting documentation.	5			v				v		
21	Aerospace exploration of natural resources	Classification of natural resources. Scientific foundations of environmental monitoring. Aerospace monitoring systems. Space remote sensing tools of medium and high spatial resolution. High spatial resolution remote sensing radar equipment. Space monitoring of forest	5			v				v		

		resources of the Republic of Kazakhstan. Monitoring forest and steppe fires. Satellite monitoring of rational use of land resources.										
Cycle of major disciplines Selectable Component												
19	Land management using WEB-GIS	The purpose of mastering the discipline "Land management with the use of WEB-GIS" with the use of WEB-GIS is to form a holistic view of land use management in modern conditions, knowledge of the scientific and theoretical foundations of land use management.	5		**v**				**v**			
20	WEB-GIS	Formation of ideas and understandings about the concepts and technical foundations of web GIS; exploring the possibilities of web GIS technologies using ESRI products (ArcGIS online, server) and open resources (QGIS, Mapserver, Geoserver); geospatial web services, geoportals, meshes, mobile GIS, creating interactive online maps for solving problems in the field of geodesy, cartography, surveying.	5						**v**	**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.K. Ilegentaev
2024 y.

CURRICULUM
of Educational Program on enrollment for 2024-2025 academic year
Educational program 7M07306- "Geospatial digital engineering"
Group of educational programs M123 - "Geogeziy"
Form of study: full-time Duration of study: 2 year Academic degree: Master of Technical Sciences

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 courses and semesters			
								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	5	150	0/0/3	105	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											
MAP709	Methods for creating and developing state geodetic networks	BD CCH	5	150	1/0/2	105	E	5			
MNG782	Sustainable development strategies	BD CCH			2/0/1						
MAP201	Aerospace environmental monitoring	BD CCH			2/0/1						
MAP713	Spatial data infrastructure	BD CCH	5	150	1/0/2	105	E	5			
MNG781	Intellectual property and research	BD CCH			2/0/1						
MAP701	Innovative methods of engineering and geodetic works	BD CCH			1/0/2						
MAP728	Mathematical modeling of field indicators	BD CCH	5	150	1/0/2	105	E			5	
MAP708	Technology for automating the land survey process	BD CCH			1/0/2						
CYCLE OF PROFILE DISCIPLINES (PD)											
M-2. Module of professional activity (university component, component of choice)											
MAP717	Big data in geosciences	PD	5	150	1/0/2	105	E	5			
MAP258	Organization of topographic and geodetic works	PD	5	150	1/0/2	105	E	5			
MAP716	Spatial analysis	PD	5	150	1/0/2	105	E		5		
MAP271	Monitoring the deformation processes of buildings and structures	PD	5	150	1/0/2	105	E		5		
MAP299	Aerospace exploration of natural resources	PD	5	150	1/0/2	105	E			5	
MAP714	Three-dimensional object modeling in GIS	PD	5	150	1/0/2	105	E		5		
MAP290	Visualization and processing of geospatial data	PD	5	150	1/0/2	105	E		5		
MAP265	Remote sensing of the Earth and natural resources	PD	4	120	1/0/2	75	E			4	
MAP238	Organization of scientific research	PD	5	150	2/0/1	105	E			5	
MAP710	WEB-GIS		5	150	1/0/2	105	E			5	
MAP712	Land management using WEB-GIS	PD			1/0/2						
M-3. Practice-oriented module											
AAP229	Pedagogical practice	BD UC	8							8	
AAP256	Research practice	PD, CCH	4								4
M-4. Experimental research module											
AAP272	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		
AAP254	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	34	26
								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	15	35
PD	Cycle of profile disciplines				53
	Total for theoretical training:	***0***	***20***	***15***	***88***
	RWMS				***24***
FA	Final attestation	8			8
	TOTAL:	**8**	**20**	**15**	**120**

Decision of the Academic Council of KazNRTU named after K.Satpayev. Protocol № 12 **от "** 22 **"** 04 **20** 24 **y.**

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Protocol № 6 **от "** 19 **"** 04 **20** 24 **y.**

Decision of the Academic Council of the Institute MMI **. Protocol №** 8 **от "** 17 **"** 04 **20** 24 **y.**

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**