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

EDUCATIONAL PROGRAM
6B07303 - «Geospatial digital Engineering»

Education Area code and classification: 6B07 Engineering Manufacturing and Civil engineering
Training area code and classification: 6B073 Architecture and Civil engineering
Group of educational programs: B074 Urban planning, construction work and civil engineering
NRC level: 6
ORC Level: 6
Duration of training: 4 years
Amount of credits: 240

Almaty 2023

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

Educational program 6B07303 - «Geospatial digital Engineering» was approved at a meeting of the Academic Council of KazNRTU named after K.I.Satpayev.
Protocol № 11 of 28.03.2023
Considered and recommended for approval at a meeting of the Educational and Methodological Council of KazNRTU named after K.I.Satpayev.
Protocol № 11 of 28.03.2023

Educational program 6B07303 - «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»	
student:				
Tokhan A.E.		3rd year student		

F KazNRTU 703-05 Educational program

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List of abbreviations and symbols

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

The Geospatial Digital Engineering educational program is a first-level qualification of three levels of the higher education system. At the expense of the qualification module and final qualification work of bachelors of the educational program.

2. The purpose and objectives of the educational program

Goal EP: The purpose of the educational program is to prepare a graduate as a competitive specialist in the field of geodesy and cartography, possessing critical thinking, able to use theoretical and practical information to perform geodetic, topographic, astronomical-geodetic, photogrammetric and cartographic work using modern geodetic equipment and geospatial digital technologies for solving applied problems.

Tasks EP:

Task 1: preparing graduates for organizational activities that exclude negative phenomena in professional activity, the development of spiritual values, moral and ethical norms of a person as a member of society, the execution of the legal and legislative system of the Republic of Kazakhstan with a high level of professional culture, civic position;

Task 2: preparing graduates for continuous self-improvement and self-development, mastering new knowledge, skills and abilities in innovative areas of geodesy and cartography;

Task 3: preparation of a graduate with acquired competencies for performing calculations of elements in geodesy and cartography, design of technical solutions, participation in the development of technical tasks for topographic, geodetic, aerospace, cartographic work on the basis of modern educational material and technical base;

Task 4: preparation of a graduate, based on the diversity and dynamism of the catalog of elective disciplines of the curriculum, with a predominance of

practical skills in competencies, capable of performing professional functions within one or more types of activities based on the final results of training, taking into account the specifics of these activities, market requirements for organizational and managerial, professional competencies;

Task 5: training of graduates as a competitive specialist in the field of geodesy and cartography, including on the basis of increasing the international aspect in educational and scientific programs, competent in the field of advanced technologies of geodesy, cartography, and registration of research results.

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	6B07 Engineering, Manufacturing and Civil engineering
2	Code and classification of training	6B073 Architecture and civil engineering
3	Group of educational programs	B074 Urban Planning, construction works and Civil engineering
4	Name of the educational program	6B07303 Geospatial Digital Engineering
5	Brief description of the educational program	Educational program "Geospatial Digital Engineering" – This is a first-level qualification of the three levels of higher education.
6	EP purpose:	The purpose of the educational program is to prepare a graduate as a competitive specialist in the field of geodesy and cartography, possessing critical thinking, able to use theoretical and practical information to perform geodetic, topographic, astronomical-geodetic, photogrammetric and cartographic work using modern geodetic equipment and geospatial digital technologies for solving applied problems.
7	EP type:	New EP
8	Level on NQF	6
9	Level on SQF	6
10	EP distinctive features	No
11	List of competencies of the educational program:	12

12	The formed educational outcomes:	1. To form the ability to communicate orally and in writing in the state, Russian and foreign languages to solve the problems of interpersonal and intercultural interaction 2. To form an understanding of the essence and meaning of information in the development of modern society, the ability to receive and process information from various sources, the willingness to interpret, structure and formalize information in a form accessible to others. 3. To discuss the main stages and patterns of the historical development of society for the formation of a civic position. 4. To explain the basics of philosophical knowledge for the formation of a worldview position. 5. Demonstrate proficiency in professional communication techniques, ability to work in a team, tolerance of perception of social, ethnic, confessional and cultural differences, awareness of the need to study independently and improve their skills throughout their working life. 6. Apply the basics of mathematical knowledge in geodesy and cartography to solve applied problems using Matlab. 7. Apply remote sensing data of the Earth in solving applied geodetic, cadastral and land management tasks; perform aerial photography of land plots using unmanned aerial vehicles; apply GIS technologies when creating maps, various subjects, digital models of terrain and objects. 8. Demonstrate knowledge in the field of creating digital models and modeling to automate the processing process based on remote sensing data, mathematical interpretation and the use of algorithms, programs for solving geodesy problems and creating maps and designing cartographic materials in a web environment, use web architecture systems and algorithms when designing maps and building web applications, creating interactive maps. 9. Apply the methods of modern geoinformation technologies in the development of digital maps, conceptual and terminological apparatus of cartography in the design and computer design of maps. 10. Demonstrate knowledge in the field of WEB-geoinformatics and modern geoinformation technologies for solving professional geodetic and cartographic tasks; use ENVI programs for photogrammetric image processing, ArcGIS and

		QGIS for image classification; create orthophotoplanes and digital terrain models based on UAV data. 11. Demonstrate a wide range of theoretical and practical knowledge in the professional field, the ability to develop, implement and control the quality and completeness of projects of high-precision and applied geodetic works. 12. Demonstrate mastery of geodetic, photogrammetric and cartographic methods; technical means of space geodesy; computer technology and automated processing of geodetic, cadastral, land management information. 13. To form the ability to carry out the main technological processes of topographic and geodetic, aerial photogrammetric and cartographic works and the ability to calculate the technical and economic efficiency when choosing technical and organizational solutions for topographic and geodetic and cartographic production. 14. Apply modern technologies for obtaining field geodetic information for mapping the territory of the country and updating the existing cartographic fund. 15. Apply ground-based and satellite positioning technologies for geodetic support of construction of engineering structures; process satellite observation data in professional software products; perform laser scanning to create high-precision three-dimensional models of industrial facilities for their inclusion in corporate management systems, construction and control, operational monitoring of particularly important objects and hazardous areas, calculation of volumes of displaced soil, movement slopes, etc.
13	Form of study	Daytime
14	Period of study	4 years
15	Volume of the credits	240
16	Language of education	Russian, Kazakh
17	The awarded academic degree	Bachelor
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	Short description of the discipline	Number of credits	Generated learning outcomes (codes)														
				LR1	LR2	LR3	LR4	LR5	LR6	LR7	LR8	LR9	LR 10	LR 11	LR 12	LR 13	LR 14	LR 15
Cycle of general education disciplines University component																		
1	The basics of anti-corruption culture	The discipline studies the essence, causes, causes of sustainable development of corruption from both historical and modern points of view. Examines the prerequisites and impacts for the development of an anti-corruption culture. Studies the development of anti-corruption on the basis of social, economic, legal, cultural, moral and ethical norms. Studies the problems of the formation of an anti-corruption culture based on the relationship with various types of social relations and various manifestations.	5	v									v					
2	Fundamentals of entrepreneurship and leadership	The discipline studies the basics of entrepreneurship and leadership from the point of view of science and law; features, problematic aspects and prospects of development; theory and practice of entrepreneurship as a system of	5	v	v					v								

		economic, organizational and legal relations of business structures; readiness of entrepreneurs for innovative receptivity. The discipline reveals the content of entrepreneurial activity, career stages, qualities, competencies and responsibilities of an entrepreneur, theoretical and practical business planning and economic expertise of business ideas, as well as risk analysis of innovative development, introduction of new technologies and technological solutions.																
3	Fundamentals of research methods	The purpose of the discipline "Fundamentals of research methods" is the formation of students' skills and abilities in the field of methodology of scientific knowledge. Brief description of the discipline. Methodological foundations of scientific knowledge. The concept of scientific knowledge. Methods of theoretical and empirical research. Choice of the direction of scientific research. Stages of research work. Research topic and its relevance. Classification, types	5	v		v												

		and tasks of the experiment. Metrological support of experimental studies. Computational experiment. Methods for processing the results of the experiment. Formulation of research results. Presentation of research work.																
4	Ecology and life safety	The discipline studies the tasks of ecology as a science, environmental terms, the laws of the functioning of natural systems and aspects of environmental safety in the conditions of labor activity. Monitoring of the environment and management in the field of its safety. Sources of pollution of atmospheric air, surface, groundwater, soil and ways to solve environmental problems; life safety in the technosphere; natural and man-made emergencies	5	**v**		**v**												
Cycle of basic disciplines University component																		
5	Higher geodesy	Master a holistic understanding of the tasks of higher geodesy, the main methods of high-precision geodetic measurements, while studying the planning, selection of methods and tools, and mathematical processing of	5				**v**						**v**					

		geodetic measurements in the creation and development of state geodetic networks by traditional methods and satellite navigation systems and must demonstrate the ability to analyze and evaluate the quality of the construction of state geodetic networks.																
6	Geodetic instruments	To master modern geodetic instruments, methods and methods of performing measurements with them, verification and adjustment of instruments, and the methodology of their research. Master satellite positioning technologies to perform topographic surveys. Learn how to perform topographic and geodetic work with the necessary accuracy to create engineering plans and maps. Be able to independently choose the necessary set of geodetic tools when solving specific tasks.	5				v						v					
7	Geodesy	He will master the basic concepts of the Shape and size of the Earth, about coordinate systems used in geodesy, about the orientation of lines on the terrain, about plans, maps, profiles, about scale, terrain	6	v	v					v								

		relief, about angular and linear measurements, about altitude measurements, about methods and measurements of topographic surveys, about the accuracy of geodetic measurements, the use of geodetic instruments, as well as cameral processing of the geodetic measurements obtained.																
8	Geoinformatics	To familiarize students with the analysis of natural and socio-economic systems through computer modeling based on geographic information systems (GIS). The student must master the algorithm and technological scheme for creating topographic maps and plans, hardware and hardware, GIS software, principles of database formation and design of specialized GIS and gain skills in creating GIS using aerospace and ground survey materials.	5				v						v					
9	Gravimetry	The purpose of the discipline is to study methods for determining the characteristics of the Earth's gravitational field in order to use them in solving scientific and practical problems of geodesy, geophysics and geology. As a	5			v									v			

		result of studying the subject, the student must master the technologies of performing gravimetric measurements, analysis and processing of gravimetric flight data, as well as master the methods of constructing maps of gravity anomalies using modern technologies.																
10	Engineering geodesy	To form theoretical knowledge and practical skills in the processing and use of geodetic information as the initial basis for making and implementing decisions in land management design, cadastral registration and valuation of real estate. To master modern methods of performing geodetic work carried out with the aim of compiling large-scale topographic and cadastral maps and plans. Be able to perform geodetic measurements to determine the boundaries of land.	5					v				v						
11	Engineering surveying linear structures	To form theoretical knowledge and practical skills in the field of obtaining, processing and using geodetic information as the initial basis for making and implementing decisions in the design, construction and	5	v		v												

		operation of engineering linear structures, the creation of geodetic plans. To master modern methods of performing geodetic works carried out during surveys of linear structures, providing topographic and geodetic plans of various scales, profiles for the design, construction and reconstruction of linear structures.																
12	Engineering and computer graphics	The course develops the following skills in students: to depict all kinds of combinations of geometric shapes on a plane, to conduct research and their measurements, allowing for image transformations; create technical drawings, which are the main and reliable means of information, providing a link between the designer and the designer, technologist, builder, in AutoCAD.	5	**v**		**v**												
13	Cartography	To study the mathematical basis of maps and types of cartographic projections. Be able to choose and justify the scale, recognize the map projection. Examine the distortions on the maps. To master the cartographic methods of depicting the relief.	5	**v**		**v**												

		To study the main sources for compiling thematic and general geographical maps. Master the basic methods of creating maps in ArcGIS.																	
14	Mathematics I	The course is based on the study of mathematical analysis in a volume that allows you to study elementary functions and solve the simplest geometric, physical and other applied problems. The main focus is on differential and integral calculus. The course sections include the differential calculus of functions of one variable, the derivative and differentials, the study of the behavior of functions, complex numbers, and polynomials. Indefinite integrals, their properties and methods of calculation. Certain integrals and their applications. Improper integrals.	5		v			v	v										
15	Mathematics II	The discipline is a continuation of Mathematics 1. The course sections include elements of linear algebra and analytical geometry. The main issues of linear algebra are considered: linear and self-adjoint operators, quadratic forms, linear programming. Differential calculus of a	5	v					v		v								

		function of several variables and its applications. Multiple integrals. The theory of determinants and matrices, linear systems of equations, as well as elements of vector algebra. The elements of analytical geometry on the plane and in space are included.																
16	Organization and planning of topographic and geodetic works	The purpose of mastering the discipline "Organization and planning of topographic and geodetic works" is to master theoretical and practical foundations during the preparation and sending of requests to technical inventory bodies.	5								v			v				
17	Applied geodesy	To study the methods of geodetic works when accompanying the design, construction and operation of engineering structures. Master the processing and evaluation of the accuracy of geodetic information and the construction of the initial basis on the construction site. To analyze the composition and organization of geodetic works in the design of structures; to argue for the use of methods and means when transferring the construction project to	5	v						v								

		nature; organize geodetic monitoring of buildings and structures during their operation.																
18	Theory of matematical processing og geodetic measurements	The purpose of studying the subject is to master the methods of processing the results of geodetic measurements, the ability to evaluate the accuracy of measurements, as well as the equalization of geodetic constructions. Within the course, the student must master the use of elements of probability theory and mathematical statistics to assess the quality of measurements performed, as well as methods of equalizing geodetic networks based on the principle of least squares.	5	v		v												
19	Topographical graphics	The discipline studies the theory and methods of graphic design of cartographic materials used in cartography, geodesy, land management, as well as the use of a graphic software package (CorelDRAW, AutoCAD, etc.). It also includes theoretical knowledge and practical skills in creating a topographic map, a land management plan, compiling and editing, preparing for	4			v								v				

		publication and publishing maps, drawing and design work, for which it is necessary not only to know the materials, drawing accessories and also to combine the methods and techniques of drawing and designing maps.																
20	Physics	The course studies the basic physical phenomena and laws of classical and modern physics; methods of physical research; the influence of physics as a science on the development of technology; the relationship of physics with other sciences and its role in solving scientific and technical problems of the specialty. The course covers the following sections: mechanics, mechanical harmonic waves, fundamentals of molecular kinetic theory and thermodynamics, electrostatics, direct current, electromagnetism, geometric optics, wave properties of light, laws of thermal radiation, photoelectric effect.	5					**v**			**v**	**v**		**v**				
21	Digital mapping	Get theoretical knowledge and practical skills in using software for creating and updating digital topographic bases, plans and	5			**v**					**v**	**v**	**v**					

		maps. To study the methods of creating digital and electronic maps, as well as the automation of cartographic work. To master the technology of creating digital topographic maps containing logical and mathematical descriptions of mapped objects and the relationships of terrain objects in the form of their combinations, intersections and neighborhood.																
22	Architecture and building structures	The discipline studies the basic provisions of the design of buildings and structures, considers their classification, main parts and elements, structural systems and schemes, basic information about building structures, including the principles of their design, as well as methods for calculating building structures. The main provisions of the calculation of structures for limiting states.	5			v					v	v	v					
Cycle of basic disciplines Component of choice																		
23	Geodetic works at industrial sites of mines and quarries	To master the methods of conducting geodetic works on industrial sites of mines and quarries to create a reference and survey network, to learn how to perform a set of survey	5					v	v									

		work for drawing up a master plan of the surface of a mineral deposit with an indication of the boundaries of mining and land allotments on it, ways of carrying out the design position of mining workings in kind, drawing up and processing the necessary reporting and graphic documentation.																
24	Geoinformation cartography	To study the sequential processes of developing digital maps and technological schemes of interaction in the GIS environment. Gain skills in creating thematic maps using GIS-based tools and structurally organize input data, visualize, and interpret the resulting data. be able to use general geographical and thematic maps, aerial imagery and statistical data for digital mapping. Be able to apply modern computer and information technologies for creating maps and atlases.	4			v					v	v		v				
25	Geodetic and engineering surveying	To study the main types of topographic and geodetic works performed to ensure the design, construction and reconstruction of various structures, as well as to perform geological, hydrometeorological and other	5			v					v							

		types of engineering surveys. To learn how to perform geodetic measurements when creating a planned, high-altitude justification for the design of engineering structures,to survey linear structures and underground utilities, to process the results of geodetic measurements and topographic surveys in order to build engineering plans and terrain profiles.																
26	Information technology in geodesy and remote sensing	The purpose of studying the discipline is to prepare students to work with the basic algorithms for processing remote sensing data. The student should know algorithms for working with large images and be able to apply Internet technologies for creating web services for storing and presenting spatial data.	5		v				v									
27	Cartometry and mathematical cartography	The purpose of studying the discipline "Cartometry and mathematical cartography" is to develop students' knowledge about the principles and methods of making measurements on maps: determining the geographical and rectangular coordinates of points, measuring the lengths of	4	v						v								

		sinuous and straight lines, calculating the volumes of surface sections, measuring angles and areas. To master ways of displaying the Earth's surface on a plane, using the mathematical basis of maps: scale, map projection, cartographic grid, coordinate grid.																
28	Basics of laser scanning	To study the principle of operation of terrestrial laser scanners, the sources of errors in laser scanning and technological schemes of terrestrial laser scanning. To master the methods of external orientation of scans and the technique of laying scanner passages. Learn how to apply scanning technology in solving problems in geodesy, construction, architecture and in the oil and gas industry.	6	v		v				v	v							
29	Fundamentals of environmental mapping	To study technologies for creating ecological maps to support state and regional environmental programs. Get an idea about the parameters of environmental pollution sources. To master the methods of collecting, analyzing and cartographic data on the state of the natural environment and be	6				v	v						v	v			

		able to create inventory-assessment, forecast, and control maps using modern mapping technologies.																
30	Web-cartography	Learn the concept of creating maps and designing cartographic materials on the web. To master the systems and algorithms of web architecture, in order to design and create interactive maps and web applications. Gain skills in using the basics of computer networks and how they work, and analyze how GIS servers and JavaScript work. Create CSS styles, graphic design, animation and effective interaction of geospatial information through a web browser.	5					**v**						**v**	**v**			
Cycle of major disciplines University component																		
31	Automanion of topographic and geodetic works	The purpose of studying the discipline is to obtain theoretical knowledge and practical skills on how to automate topographic and geodetic work in solving applied problems in the design and construction of engineering structures. Particular attention during the passage of this discipline is paid to the training	5		**v**				**v**	**v**								

		of modern automated geodetic instruments, the study of the principle of conducting topographic surveys using terrestrial laser scanning, the introduction of UAVs for the effective acquisition of geodetic data, as well as the use of satellite technologies.																
32	Aerospace survey methods	As part of the subject, students will study the theoretical foundations of the use of aerospace survey methods to solve geodesy and cratography problems. The physical and geometric foundations of aerial surveys, platforms and sensors of space surveys of various ranges will be considered. Students will gain skills in processing aerospace images using various software products, learn how to perform georeferencing of images, classify depicted objects, and create orthophotomaps, digital terrain and relief models.	5	v					v									
33	Remote sensing of the earth	To master the methods of processing and analyzing satellite imagery data in solving cartographic, geodetic and environmental problems. To study the physical foundations of remote sensing of the Earth,	6				v						v					

		modern sensors, and operating platforms. Master the technology of space imagery processing, including image enhancement and image interpretation methods, and learn how to select remote sensing data for solving environmental problems.																
34	Basics of the cadastre	Master the basics of land, water, legal and multifunctional cadastre, as well as the system of accounting, registration and evaluation of land. To study the procedure for carrying out cadastral activities, automate the information system of the state land cadastre, which allows filling out basic land cadastral documents, providing information support for decisions of executive authorities, providing information support to the real estate market, developing market relations, protecting and rationally using land.	5							v		v		v				
35	Photogrammetry	To train specialists in the basics of theoretical and practical knowledge of modern photogrammetric processes, including methods of performing aerial surveys, their cameral processing, and	5					v	v									

		analyzing the accuracy of the materials obtained, as well as methods of using them to create and update topographic maps and plans. Master the processing of aerial images from UAVs in photogrammetric programs in order to create orthophotoplanes and digital terrain models.																
35	Geodetic support for the construction of unique buildings and structures	To study the methods of engineering and geodetic works for the maintenance and construction of the construction of unique buildings and structures. Know the regulatory documents on the production and accuracy of geodetic works during the construction and operation of unique buildings and structures. To master the methods of creation and technical characteristics of geodetic justification support for the construction of unique buildings and structures. Be able to use high-precision geodetic instruments, perform center work and organize geodetic observations of deformations of unique structures	5	**v**	**v**													
Cycle of major disciplines Component of choice																		

36	Geodetic support for the construction of unique buildings and structures	To study the methods of engineering and geodetic works for the maintenance and construction of the construction of unique buildings and structures. Know the regulatory documents on the production and accuracy of geodetic works during the construction and operation of unique buildings and structures. To master the methods of creation and technical characteristics of geodetic justification support for the construction of unique buildings and structures. Be able to use high-precision geodetic instruments, perform center work and organize geodetic observations of deformations of unique structures	5	v	v													
37	Global navigation satellite systems	To study the basic principles of satellite positioning technologies, absolute and relative methods of satellite measurements, the differential method of GNSS, as well as the specifics of the use of pseudo ranging and phase measurements. Familiarize yourself with the coordinate and time systems used in satellite observations. To master	4		v					v								

		methods for calculating the instantaneous position of satellites and orbital parameters of satellites, as well as methods for calibrating and equalizing satellite measurements. Learn how to use GNSS observations to create satellite geodetic networks.																
38	Monitoring of deformations of structures	Geodynamics as scientific discipline. Modern value of geodynamics at various scales of its use (global, regional, local). Geodynamic tasks of geodesy. Classification of the geodynamic phenomena. Geodynamic grounds, their purpose and appointment. Research SGDZP on GDP. High-precision angular and linear measurements on GDP. Studying of SVDZK according to repeated leveling. GPS – supervision on GDP.	6				**v**						**v**					
39	Fundamentals of digital photogrammetry	As part of the study of the discipline, students will study the theoretical foundations of photogrammetry, modern methods, systems and software products for digital photogrammetric processing and master the complex of knowledge necessary to use digital photogrammetry	5		**v**			**v**		**v**								

		methods to solve geodetic problems. Students will also learn how to perform photogrammetric processing of images in the ENVI program, perform image classification in ArcGIS and QGIS software, and process UAV data in the Agisoft program.																
40	Web-GIS basics	Master the acquisition of theoretical and practical skills of working in WEB-geoinformation systems and modern geoinformation technologies, possess the skills of using software and working in computer networks, the ability to create databases and use Internet resources, WEB portals, own software and software, GIS technologies, be able to work with information from various sources to solve professional and social problems.	4					v	v	v								
41	Applied photogrammetry	Possess the theoretical foundations of photogrammetry, methods of photogrammetric processing of aerospace and ground images. Learn how to make topographic and cadastral plans based on aerospace survey data. Obtaining skills in modern	5															

		photogrammetric software products. Be able to select space images of the required resolution, perform their primary processing and classification, as well as receive information about dynamic processes for solving environmental problems. Master the methodology of working with unmanned summer jobs.																
42	Thematic mapping	To master the technology of creating thematic maps reflecting all phenomena and objects in their mutual connection and development. To study the mathematical basis, cartographic image, legend of conventional signs, as well as auxiliary equipment and additional data. Master the methodology of creating thematic maps using modern information technologies, methods of analyzing raw materials and be able to create physical-geographical, socio-economic maps and maps of environmental assessment and forecasting.	5															
43	Economics and management of cartographic production	The nature of the geographic data and the methods by which they are displayed on maps.	5															

		Representation of spatial data. Preparation of the map and the process of digitization. Methods of cartographic images. Methods for input of vector data. Remote sensing as a special case of input raster data. Subsystem of storage and editing GIS. Cartographic overlay. Graphic errors in vector systems. Methods of drawing up, preparing for publication and issuing maps. Elementary spatial analysis. Measurement of lengths, perimeters, areas in raster and vector systems. Measures of form.																
44	Economics and management of topogeodetic production	To form an idea of the economics of industrial production and methods of solving economic problems that arise in the process of topogeodesic and cartographic work. Be able to carry out calculations of economic efficiency and investment projects of engineering and geodetic works. Know the organization of product quality control in the main structural and auxiliary divisions of cartographic and geodetic enterprises, the standard	5															

		structure of the financial management system of the cartographic and geodetic industry.																

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 2023-2024 academic year

Educational program 6B07303 - "Geospatial digital engineering"
Group of educational programs B074 - "Urban planning, construction works and civil engineering"

Form of study: full-time | Duration of study: 4 years | Academic degree: Bachelor of Engineering and Technology

Discipline code	Name of disciplines	Cycle	Total amount in credits	Total hours	classroom volume of lek/lab/pr	SIS (including TSIS) in hours	Form of control	Allocation of face-to-face training based on courses and semesters: I course		II course		III course		IV course	
								1 semester	2 semester	3 semester	4 semester	5 semester	6 semester	7 semester	8 semester
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)															
M-1. Module of language training															
LNG 108	English language	GED, RC	10	300	0/0/6	210	E	5	5						
LNG 104	Kazakh (Russian) language	GED, RC	10	300	0/0/6	210	E	5	5						
M-2. Module of physical training															
KFK 101-124	Physical Culture	GED, RC	8	240	0/0/8	120	Differdit	2	2	2	2				
M-3. Module of information technology															
CSE 677	Information and communication technologies (in English)	GED, RC	5	150	2/1/0	105	E				5				
M-4. Module of socio-cultural development															
HUM 137	History of Kazakhstan	GED, RC	5	150	1/0/2	105	SE		5						
HUM 132	Philosophy	GED, RC	5	150	1/0/2	105	E				5				
HUM 120	Socio-political knowledge module (sociology, politology)	GED, RC	3	90	1/0/1	60	E				3				
HUM 134	Socio-political knowledge module (culturology, psychology)		5	150	2/0/1	150	E			5					
M-5. Module of anti-corruption culture, ecology and life safety base															
HUM 136	Fundamentals of anti-corruption culture and law	GED, CCH	5	150	2/0/1	150	E								
MNG489	Fundamentals of economics and entrepreneurship														
HPP528	Scientific research methods														
CHE 656	Ecology and life safety														
CYCLE OF BASIC DISCIPLINES (BD)															
M-6. Module of physical and mathematical training															
MAT101	Mathematics I	BD, UC	5	150	1/0/2	105	E	5							
PHY468	Physics	BD, UC	5	150	1/1/1	105	E	5							
MAT102	Mathematics II	BD, UC	5	150	1/1/2	105	E		5						
M-7. Module of basic training															
GEN429	Engineering and computer graphics	BD, UC	5	150	1/0/2	105	E	5							
MAP570	Topographical graphics	BD, UC	3	90	0/0/2	75	E	3							
MAP536	Geodesy	BD, UC	6	180	2/0/2	120	E		6						
MAP537	Cartography	BD, UC	6	180	2/0/2	120	E			6					
M-8. Module of engineering and geodetic works															
MAP475	Technical inventory of real estate	BD, UC	5	150	1/0/2	105	D			5					
MAP477	Digital mapping	BD, UC	5	150	1/0/2	105	D				5				
MAP478	Theory of mathematical processing of geodetic measurements	BD, UC	5	150	1/0/2	105	D				5				
MAP114	Geoinformatics	BD, UC	5	120	1/0/2	75	D				5				
MAP488	Organization and planning of topographic and geodetic works	BD, UC	5	150	1/0/2	105	D					5			
MAP481	Geodetic instruments	BD, UC	5	150	1/0/2	105	D					5			
MAP574	Engineering surveying linear structures	BD, UC	4	150	1/0/2	105	D					4			
CIV591	Architecture and building structures	BD, UC	5	150	1/0/2	105	D					5			
MAP479	Higher geodesy	BD, UC	5	150	1/0/2	105	D					5			
CIV582	Technology of building manufacture I	BD, UC	5	150	2/0/1	105	D						5		
MAP482	Gravimetry	BD, UC	5	150	1/0/2	105	D						5		
MAP498	Applied geodesy	BD, UC	5	150	1/0/2	105	D							5	
MAP466	Web-cartography	EJL, KB	5	150	1/0/2	105	D						5		
MAP473	Information technology in geodesy and remote sensing				1/0/2										
MAP484	Cartometry and mathematical cartography	EJL, KB	4	150	1/0/2	105	D						4		
MAP113	Geoinformation cartography				1/0/2										
MAP486	Geodetic works at industrial sites of mines and quarries	EJL, KB	5	150	1/0/2	105	D							5	
MAP497	Geodetic and engineering surveying				1/1/1										
MAP556	Geodetic and engineering surveying	EJL, KB	6	180	2/0/2	120	D							6	
MAP555	Fundamentals of environmental mapping				2/0/2										
	Educational practice	BD, UC													
CYCLE OF PROFILE DISCIPLINES (PD)															
M-9. Module of professional activity															
MAP436	Basics of the cadastre	PD, UC	5	150	1/0/2	105	D			5					
MAP155	Photogrammetry	PD, UC	5	150	1/0/2	105	D					5			
MAP485	Aerospace survey methods	PD, UC	5	150	1/0/2	105	D						5		
MAP541	Remote sensing of the earth	PD, UC	6	180	2/0/2	120	D							6	
M-10. Модуль проектирования технологий работ															
MAP100	Automation of topographic and geodetic works	PD, UC	5	120	1/0/2	75	D							5	
MAP557	Monitoring of deformations of structures	PD, UC	6	180	2/0/2	120	D							6	
MAP543	Economics and management of cartographic production	EJL, KB	5	150	1/0/2	105	D								5
MAP139	Economics and management of topogeodetic production				1/0/2										

MAP148	Applied photogrammetry	ПД, КВ	5	150	1/0/2	105	Э									3
MAP198	Fundamentals of digital photogrammetry				1/0/2											
MAP467	Geodetic support for the construction of unique buildings and structures	ПД, КВ	5	150	1/0/2	105	Э									3
MAP422	Thematic mapping				1/0/2											
MAP540	Web-GIS basics	ПД, КВ	4	150	1/0/2	105	Э									4
MAP544	Global navigation satellite systems				1/0/2											
	Production practice I	PD, UC														
	Production practice II	PD, UC														
M-11. Module of final attestation																
ECA108	final examination	FA	8													8
M-12. Module of additional types of training																
AAP500	Military affairs	ATT	0					30	30	30	30	30	30	30	30	
Total based on UNIVERSITY:								60		60		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	51		5	56
BD	Cycle of basic disciplines				176
PD	Cycle of profile disciplines				
	Total for theoretical training:	51			232
FA	Final attestation	8			8
	TOTAL:	59	0	0	240

Decision of the Academic Council of Kazntu named after K.Satpayev. Protocol № 5 24 november 2022 y.

Decision of the Educational and Methodological Council of Kazntu named after K.Satpayev. Protocol № 3 17 november 2022 y.

Decision of the Academic Council of the Institute_____ Protocol № 3 от «15» 11 2022 г.

Vice-Rector for Academic Affairs **B.A. Zhautikov**

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

Head of the Department " Mine surveying and geodesy" **E. O. Oryndassarova**

Specialty Council representative from employers **A.T. Aimanov**