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

EDUCATIONAL PROGRAM
6B07314 – «Geodesy and cartography»

Code and classification of the field of education: **6B07 Engineering Manufacturing and Civil engineering**
Code and classification of training directions: **6B073 Architecture and Civil engineering**
Group of educational programs: **B074 Urban planning, construction work and civil engineering**
Level based on NQF:6
Level based on IQF:6
Study period: 4 years
Amount of credits: 240

Almaty 2025

Educational program 6B07314 – «Geospatial digital Engineering» was approved at a meeting of the Academic Council of KazNRTU named after K.I.Satbayev.
Protocol №6 of 31.03.2025
Considered and recommended for approval at a meeting of the Educational and Methodological Council of KazNRTU named after K.I.Satbayev.
Protocol №2 of 12.03.2025

Educational program 6B07314 – «Geospatial digital Engineering» developed by the academic committee in the direction of «Architecture and Civil engineering»

Full name	Academic degree/ academic title	Position	Place of work	Signature
Academic staff:				
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Aitkazinova Shynar Kasymkanovna	PhD	Associate Professor	NPJSC «K.I. Satbayev Kazakh National Research Technical University»	
Employer:				
Mukhametov Yesen Serikovich	-	Acting Director	Almaty Regional Branch of RSE «GOSGRADCADASTR»	
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List of abbreviations and symbols

Reduction	Full name
SU	Satbayev University
MSHE RK	Ministry of Science and Higher Education of the Republic of Kazakhstan
AS	Academic staff
EP	Educational program
WC	Working curriculum
GIS	Geographic information system
LOED	Learning outcomes of the educational program
BD	Basic discipline
PD	Profile discipline
TUC	The university component
CC	Component of choice
SDG	Sustainable Development Goals
TUN	The United Nations

The Geodesy and Cartography educational program contributes to the achievement of the priority Sustainable Development Goals approved by the United Nations through the training of highly qualified specialists with competencies in spatial positioning, environmental monitoring, and the creation of digital maps and geographic information systems. Graduates of the program play a key role in ensuring the sustainable development of territories, effective management of natural resources and improving infrastructure security. The OP contributes to the achievement of the following SDGs:

SDG 4. Quality education is the formation of a sustainable system of high-quality, inclusive and affordable education that provides lifelong learning opportunities

SDG 9. Industrialization, innovation and infrastructure - the development of sustainable infrastructure and the introduction of scientific and technological innovations into the economy of the region and the country.

SDG 12. Responsible consumption and production is the development of a system of environmentally responsible consumption and production based on the principles of reduction, reuse and recycling.

SDG 13. Combating climate change – using geospatial technologies to monitor changes in the environment;

SDG 15. Conservation of terrestrial ecosystems is the monitoring and assessment of land use aimed at protecting and restoring natural ecosystems.

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 construction industries
2	Code and classification of training directions	6B073 Architecture and construction
3	Educational program group	B074 Urban planning, construction works and civil engineering
4	Educational program name	6B07314 Geodesy and cartography
5	Short description of educational program	The educational program "Geodesy and Cartography" is aimed at training specialists who study methods and skills in the field of geodetic measurements, mapping and processing of geographical information. The program examines the theoretical and practical tasks of geodesy, cartography, remote sensing of the Earth and geoinformatics. Main areas of study: - Geodetic and cartographic works; - Technologies for obtaining and processing geodetic data; - Creation and updating of topographic maps and plans; - The use of modern technologies in cartography and geographic information systems (GIS); - Application of satellite navigation methods and technologies; -Application of remote sensing data - Lands for solving cartographic and thematic tasks. Graduates of the program can work in various fields: in geodetic and cartographic organizations, construction companies and mining enterprises, government authorities, as well as in companies engaged in solving a wide range of tasks using geospatial data.
6	Purpose of EP	The purpose of bachelor's degree in Geodesy and Cartography is to provide high-quality training for specialists in the field of geodesy and cartography, to provide personnel to research institutes, industrial organizations, national and regional land committees working with spatial data on the earth's surface and objects on it, with information about the Earth's interior, as well as coordinate-temporary linking of objects that study the dynamics of landscape changes and processes on the Earth's surface; performing the collection, processing and dissemination of geographic information data on the territory of Kazakhstan, with the aim of developing the digital infrastructure of the state.
7	Type of EP	New EP
8	The level based on NQF	6
9	The level based on IQF	6

10	Distinctive features of EP	No
11	List of competencies of educational program	**General cultural competencies (GCC)** **GCC-1.** The ability to communicate effectively in Russian, Kazakh and a foreign language in a professional environment. **GCC-2.** Teamwork skills, interaction with colleagues and customers. **GCC-3.** The ability to make decisions in non-standard situations, critical thinking. **GCC-4.** Self-organization, time planning, goal setting. **General Professional Competencies (GPC)** **GPC-1.** Knowledge of the regulatory framework of geodetic and cartographic activities. **GPC-2.** Knowledge of methods of geodetic measurements and topographic surveys. **GPC-3.** Skills in working with geodata and creating digital maps and models. **GPC-4.** Application of remote sensing methods and interpretation of remote sensing data. **GPC-5.** Understanding of environmental, legal and engineering aspects in geodesy. **Professional Competencies (PC)** **PC-1.** Performing high-precision geodetic work at various stages of construction. **PC-2.** Conducting aerospace and photogrammetric surveys, creating orthophotoplanes. **PC-3.** Creation of thematic, cadastral and engineering maps. **PC-4.** Processing and interpretation of spatial data in specialized programs. **PC-5.** Participation in the design of linear and unique structures with geodetic support. **PC-6.** Development and maintenance of geodetic documentation, reporting, scientific publications. **Digital Competencies (DC)** **DC-1.** Knowledge of programs for geo-processing (ArcGIS, QGIS, AutoCAD, Agisoft, ENVI, etc.). **DC-2.** Ability to work with digital maps, satellite images, 3D models, GNSS data. **DC-3.** Knowledge of databases and geospatial information storage systems. **DC-4.** The use of Web cartography, Web-GIS and cloud platforms in professional activities.
12	Learning outcomes of the educational program:	1.Demonstrates knowledge of modern methods and technologies of digital mapping, photogrammetry, remote sensing of the Earth, geoinformatics and Web-GIS; has skills in working with engineering and computer graphics, photogrammetric analysis, 3D modeling and the basics of environmental and landscape mapping; It is capable of using geoinformation systems, automated cartographic and geodetic methods (ACMS), as well as artificial intelligence

		technologies to solve applied problems in the field of geodesy, cartography, environmental monitoring and landscape design. 2.As a result of the training, the student demonstrates knowledge of the basics of anti-corruption culture and legal norms, financial literacy, economics and Develop the ability to implement basic technological processes in the field of topographic, geodetic, aerial photogrammetric and cartographic work, as well as the ability to calculate technical and economic efficiency when choosing technical and organizational solutions for topographic, geodetic and cartographic production.entrepreneurship, ecology and life safety, as well as land law; is able to apply the acquired knowledge in professional activities, comply with legislation, ensure environmental and legal safety, and make informed financial and economic decisions. 3.The student demonstrates knowledge of the theoretical foundations and practical methods of topographic graphics, geodesy, engineering, higher and space geodesy; has skills in working with geodetic instruments and modern measuring technologies; is able to perform engineering and geodetic surveys, perform geodetic work on linear structures, industrial sites, mines and quarries, as well as analyze, design and interpret measurement results in accordance with regulatory requirements. 4.Shows a confident command of geodetic, photogrammetric and cartographic methods, as well as knowledge of technical means of space geodesy, computer technology and technologies for automated processing of geodetic, cadastral and land management information. 5.Develop the ability to implement basic technological processes in the field of topographic, geodetic, aerial photogrammetric and cartographic work, as well as the ability to calculate technical and economic efficiency when choosing technical and organizational solutions for topographic, geodetic and cartographic production. 6.Demonstrate the ability to conduct professional communication, work in a team, show tolerance for differences in social, ethnic, religious and cultural aspects, as well as realize the importance of continuous learning and improving their skills in the course of professional activity. 7.The student demonstrates knowledge of the physical foundations of the processes used in geodesy, the principles of operation of geodetic and gravimetric instruments, as well as basic concepts of electrical engineering and electronics; is able to apply the knowledge gained when working with measuring equipment, set up, verify and operate instruments, carry out gravimetric measurements and use elements of electrical and electronic systems in geodetic practice. 8.The student demonstrates knowledge of the geological and hydrogeological conditions of construction, construction

		production technologies and methods of geodetic control over the condition of buildings and structures; is able to assess the engineering, geological and hydrogeological conditions of the site, plan and organize construction work taking into account natural factors, as well as perform geodetic observations of deformations of objects using modern methods and instruments. 9.Use ground-based and satellite positioning technologies for geodetic support of the construction of engineering structures, process satellite observation data using professional software products, as well as conduct laser scanning to create high-precision 3D models of industrial facilities that are integrated into corporate management systems, construction monitoring, control, operational monitoring of critical facilities and hazardous areas, volume calculation displaced soil, slope movements, and other parameters. 10.Apply the fundamentals of mathematical knowledge in geodesy and cartography to solve applied problems. 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.
13	Education form	Full-time
14	Period of training	4 years
15	Amount of credits	240
16	Languages of instruction	Russian, kazakh, english
17	Academic degree awarded	Bachelor of engineering and technology
18	Developers and authors:	Department of 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	LR10	LR11	LR12	LR13	LR14	LR15
Cycle of general education disciplines University component																		
1	Foreign language	English is a compulsary subject. According to the results of placement test or IELTS score, students are placed into groups and disciplines. The name of the discipline corresponds to the level of English. When passing from level to level, prerequisites and postrequisites are respected.	5	v														
2	Kazakh (russian) language	Kazakh (Russian) language In this course author considers socio-political, socio-cultural spheres of communication and functional styles of the modern kazakh (russian) language. The course covers the specifics of the scientific style to develop and activate professional communication skills and abilities of students. Also it allows students to leavn the basics of scientific style practically and develop the ability of production structural and semantic text analysis.	5	v														
3	Physical culture	The purpose of the discipline is to	8	v														

		master the forms and methods of forming a healthy lifestyle within the framework of the professional education system. Familiarization with the natural-scientific basics of physical education, knowledge of modern health-improving technologies, basic methods of independent physical education and sports. As part of the course, the student will master the rules of judging in all sports.																
4	Information and communication technology	The aim of the course is to gain theoretical knowledge in information processing, the latest information technologies, local and global networks, the methods of information protection; Getting the right use of text editor editors and tabulators; creation of base and different categories of applications.	5				v											
5	History of Kazakhstan	The purpose of the discipline is to provide objective historical knowledge about the main stages of the history of Kazakhstan from ancient times to the present day; introduce students to the problems of the formation and development of statehood and historical and cultural processes; contribute to the formation of humanistic values and patriotic feelings in the student; teach the student to use the acquired historical knowledge in educational, professional and everyday life;	5		v													

		evaluate the role of Kazakhstan in world history.																
6	Philosophy	The purpose of the discipline is to teach students the theoretical foundations of philosophy as a way of knowing and spiritually mastering the world; developing their interest in fundamental knowledge, stimulating the need for philosophical assessments of historical events and facts of reality, assimilating the idea of the unity of the world historical and cultural process while recognizing the diversity of their skills in applying philosophical and general scientific methods in professional activities.	5				**V**										
7	Module of socio-political knowledge (sociology, political science)	The objectives of the disciplines are to provide students with explanations on the sociological analysis of society, about social communities and personality, factors and patterns of social development, forms of interaction, types and directions of social processes, forms of regulation of social behavior, as well as primary political knowledge that will serve as a theoretical basis for understanding social -political processes, for the formation of political culture, development of a personal position and a clearer understanding of the extent of one's responsibility; help to master the	3				**V**										

		political, legal, moral, ethical and socio-cultural norms necessary to act in the interests of society, form personal responsibility and achieve personal success.																	
8	Module of socio-political knowledge (cultural studies, psychology)	The purpose of the disciplines is to study the real processes of cultural creative activity of people who create material and spiritual values, identify the main trends and patterns of cultural development, changes in cultural eras, methods and styles, their role in the formation of man and the development of society, as well as master psychological knowledge for the effective organization of interpersonal interaction, social adaptation in the field of their professional activities.	5			v													
General education curriculum Elective component																			
9	Fundamentals of economics and entrepreneurship	To develop basic knowledge of economic processes and skills in entrepreneurial activities. The course aims to develop skills in analyzing economic concepts such as supply and demand, and market equilibrium. It includes the basics of creating and managing a business, developing business plans, risk assessment, and strategic decision-making.	5	v	v					v									
10	Basics of Financial Literacy	Formation of financial literacy of students on the basis of building a direct link between the acquired	5																

		knowledge and their practical application. Using in practice all kinds of tools in the field of financial management, saving and increasing savings, competent budget planning, obtaining practical skills in calculating, paying taxes and correctly filling out tax reports, analyzing financial information, orienting in financial products to choose adequate investment strategies.																	
11	Law basics	The purpose of the study: To attain knowledge in legal sphere in order to use them effectively in engineering activity; To make students know about efficient management of a work collective basing on legal mechanisms. Short content: the course allows students to get knowledge about specified directions of law, to organize information about subject and object of legal relations, about the main institutes and functions of legal directions. Expected results: After the course studying students should know, how to use legal norms in particular situations, how to make necessary documents and how to use special legal measures to restore broken rights.	5																

Cycle of basic disciplines University component																		
12	Higher geodesy	The aim is to study geodetic methods for creating a coordinate basis on the physical surface of the Earth to solve geodesy problems. To study the shape of the Earth, its gravitational field. To study the methods of high-precision geodetic measurements, mathematical processing of geodetic measurements in the creation, development and evaluation of the quality of construction of state geodetic structures	5				v						v					
13	Geodetic instruments	Of studying of discipline "Geodezicheskoe instrumentology" is the study of the design and technical features optical and mechanical surveying instruments, evaluate the accuracy of the instrument. The study of the full cycle (podgotovka, working and receiving data) work with geodetic instruments. Device and principle of operation of geodetic tools. Definition of precision, detection and komentiranje factors influencing the measurement accuracy. Segments and types of modern GNSS receivers. Types of modern tools, their similarities and differences principially.	5				v						v					

14	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 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.	6	v	v					v								
15	Geoinformatics	Formation of a complex of knowledge in the field of using GIS, when creating digital models, acquiring knowledge and skills in using modern GIS in various types of professional and social activities. Master the methods of creating topographic maps and plans using GIS technology, the principles of creating databases, gain skills in creating GIS using materials from aerospace and ground surveys.	5				v						v					
16	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. Theory of the Earth's gravitational field,	5			v									v			

		determination of the Earth's surface and gravitational field from measurements of gravity, measurement of gravity and second derivatives of the gravity potential, study of gravimeters and laying out gravimetric passages, processing of measurement results and assessment of their accuracy, application of gravimetry in solving geodetic problems.																
17	Engineering geodesy	Formation of theoretical knowledge and practical skills in the field of obtaining, processing and using geodetic information as the initial basis for decision-making and implementation in the design, construction and operation of engineering systems It contains a full range of topics on methods and means of production of geodetic measurements on the Earth's surface, aimed at forming the foundations of engineering geodesy as a modern complex fundamental science, and at developing skills in using ready-made planning and topographic materials in solving engineering and practical problems.	5					v				v						
18	Engineering and computer graphics	To develop students' knowledge of drawing construction and skills in developing graphical and textual design documentation in accordance with standards.	5	v		v												

		Students will study ESKD standards, graphic primitives, geometric constructions, methods and properties of orthogonal projection, Monge's projection, axonometric projections, metric tasks, types and features of connections, creating part sketches and assembly drawings, detailing, and creating complex 3D solid objects in AutoCAD.																
19	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. To study the main sources for compiling thematic and general geographical maps. Master the basic methods of creating maps in ArcGIS.	5	v		v												
20	Mathematics	The purpose of mastering the discipline is to form the theoretical and practical foundations of mathematics and its applications. On the basis of studying the mathematics section, to give students the development of thinking and the achievement of mathematical culture, which is necessary for application in future professional activities. The course is based on the study of mathematical	5		v			v	v									

		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..																
21	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							

22	Organization and planning of topographic and geodetic works	The discipline "Organization and planning of topographic and geodetic works" is the development of theoretical and practical foundations in the preparation and direction of requests to public authorities, local self-government. Technical inventory for the provision of documents necessary for the implementation of state cadastral registration and for the provision of information for decision-making based on the results of land cadastral procedures.	5								v			v				
23	Theory of matematical processing og geodetic measurements	Students study methods of mathematical processing of the results of geodetic measurements, the ability to assess the accuracy of measurements, as well as perform adjustment of geodetic constructions. As part of the course, the student must master the basics of probability theory, mathematical statistics and error theory in order to assess the quality of measurements performed and pre-calculate the accuracy of planned measurements, as well as gain skills in performing adjustments of geodetic networks based on the principle of least squares, parametric and correlated methods.	5	v		v												
24	Topographical graphics	The discipline studies the theory and methods of graphic design of cartographic materials used in	3			v								v				

		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 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.																
25	Digital mapping	Get theoretical knowledge and practical skills in using software for creating and updating digital cadastral plans and maps. To study methods for creating digital and electronic maps, as well as automation of cartographic support for land management work. To master the technology of creating digital topographic maps containing logical and mathematical descriptions of mapped objects and the relationship of terrain objects in the form of their combinations, intersections and neighborhoods.	5			v					v	v	v					
26	Fundamentals of electronics and electrical engineering	"Fundamentals of electrical engineering and electronics" studies the units of measurement of current strength, voltage, electric current	5		v				v									

		power, conductor resistance; methods for calculating and measuring the main parameters of simple electrical, magnetic and electronic circuits; properties of direct and alternating electric current; principles of serial and parallel connection of conductors and current sources; electrical measuring instruments (ammeter, voltmeter), their device, principle of operation and rules for inclusion in an electrical circuit; properties of the magnetic field; motors of direct and alternating current, their device and principle of operation; rules for starting and stopping electric motors installed on equipment in operation.																
Cycle of basic disciplines Elective component																		
27	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 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.	5					**V**	**V**									

28	Fundamentals of scientific research	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 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.	5	v		v													
29	Hydrogeology and fundamentals of geology	The purpose of mastering the discipline is to master the basic methods of geological and hydrogeological research, the first information about the material composition of the Earth's crust - minerals and rocks and their formation, consideration, general characteristics of the main structural elements of the Earth, their structure and evolution, origin and factors of formation of the composition, structure of the underground	5																

		hydrosphere.																
30	Engineering Geology	The purpose of the course: the acquisition of theoretical knowledge about the engineering-geological features and properties of rocks, geological and engineering-geological processes occurring in these rocks, engineering-geological conditions of various territories, the study of which is necessary to predict their changes during economic development. Geotechnical properties of rocks. The concept and characteristics of soils. Geological zoning. Methods of engineering and geological research, engineering and geological research for various types of construction. Principles of monitoring exogenous geological processes. Regional Engineering Geology.	5															
31	The basics of anti-corruption culture	The course introduces students to the improvement of socio-economic relations of Kazakhstan society, psychological features of corrupt behavior. Special attention is paid to the formation of an anti-corruption culture, legal responsibility for acts of corruption in various spheres. The purpose of studying the discipline "Fundamentals of anti-corruption culture" is to increase public and individual legal awareness and legal culture of students, as well as the	5															

		formation of a knowledge system and a civic position on combating corruption as an antisocial phenomenon. Expected results: to realize the values of moral consciousness and follow moral norms in everyday practice; to work on improving the level of moral and legal culture; to use spiritual and moral mechanisms to prevent corruption.																
32	Technology of building manufacture I	The discipline studies the basic provisions of the construction industry, the most advanced methods of building processes; the main technologies for the erection of buildings and structures and the development of directive organizational and technological documentation on this informative basis.	5							v	v							
33	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 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,	5	v		v												

		profiles for the design, construction and reconstruction of linear structures.																
34	Ecology and life safety	The discipline studies the main approaches to solving environmental problems; sources and types of environmental pollution by transport enterprises; methods of reducing harmful effects on the environment. Natural and man-made emergencies, their causes, methods of prevention and protection. Carrying out rescue and other urgent work, rules of behavior of people in emergency situations.	5	v		v												
35	ESG principles in inclusive culture	Geological disciplines Determination of the main ore-forming minerals (ores of non-ferrous, ferrous, rare metals); determination of minerals, determination of the main igneous, sedimentary and metamorphic rocks. In the process of studying this subject, the student should get an idea of the material composition of minerals, rocks, ores, the formation of MPI, the role of exogenous and endogenous processes in the formation of minerals, engineering and geological conditions of mineral deposits and geological data necessary for the design of construction and operation Mountain constructions.	5													v	v	
36	Engineering and	The purpose of studying the	5															

	geodetic surveys during construction	discipline is a complex of measurements, calculations and geometric constructions on the ground and drawings in order to ensure the correct and accurate placement of buildings and structures, as well as the construction of their space-planning and structural elements in accordance with the project and the requirements of regulatory documents.																
37	Fundamentals of sustainable development and ESG projects in Kazakhstan	The goal is for students to master the theoretical foundations and practical skills in the field of sustainable development and ESG, as well as to develop an understanding of the role of these aspects in the modern economic and social development of Kazakhstan. Introduces the principles of sustainable development and the implementation of ESG practices in Kazakhstan, includes the study of national and international standards, analysis of successful ESG projects and strategies for their implementation in enterprises and organizations.	5			v					v	v		v				
38	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	6	v		v				v	v							

		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.																
39	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 able to create inventory-assessment, forecast, and control maps using modern mapping technologies.	6				v	v						v	v			
40	Land law	Master knowledge in the field of legal regulation of land relations. Students will know the features of the processes of formation of the system of the legal basis for land management and the cadastre, the legislative framework for land legal relations regarding real estate. They will get acquainted with the issues of the legal cadastre, the principles of the right to a land plot, real estate, methods of legal regulation of land and property relations in accordance with the legislation of the Republic of Kazakhstan.	5							v	v							
41	Web-GIS basics	Master the acquisition of theoretical and practical skills of working in	5					v	v	v								

		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.																	
42	Web-cartography	The concepts of map creation and map material design in a Web-oriented environment will be studied. The discipline is an alternative discipline to «Web-GIS basics». Gain skills in the use of the basics of computer networks and their mechanisms, and analyze the principles of GIS servers and JavaScript. Master the systems and algorithms of web architecture, in order to design and create interactive maps and web applications in the tasks of land management and cadastre.	5															**v**	**v**
43	Legal regulation of intellectual property	The goal is to form a holistic understanding of the system of legal regulation of intellectual property, including basic principles, mechanisms for protecting intellectual property rights and features of their implementation.	5																

		The discipline covers the basics of IP law, including copyright, patents, trademarks, and industrial designs. Students learn how to protect and manage intellectual property rights, and consider legal disputes and methods for resolving them.																	
44	Landscape science	To master the structural elements of the landscape shell and the principles of its systemic organization, the natural geographical components of landscapes (geosystems), their unity, interconnections and interdependence. To study the main methods of landscape research and features of the organization of complex geographical research; criteria for assessing territorial ecological situations, landscape systematics and types of landscapes on the Earth. Know the factors, mechanisms and history of the formation of anthropogenic landscapes, as well as the principles of anthropogenic compatibility.	5																
45	Landscape Design	To master the structural elements of the landscape shell and the principles of its systemic organization, the natural geographical components of landscapes (geosystems), their unity, interconnections and interdependence. To study the main methods of landscape research and	5																

		features of the organization of complex geographical research; criteria for assessing territorial ecological situations, landscape systematics and types of landscapes on the Earth. Know the factors, mechanisms and history of the formation of anthropogenic landscapes, as well as the principles of anthropogenic compatibility.																	
Cycle of profile disciplines University component																			
46	Automation of topographic and geodetic works	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 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.	5		v				v	v									
47	Aerospace survey methods	Theoretical foundations of the application of aerospace survey methods to solve geodesy and cratography problems. The physical and geometric foundations of aerial surveys, platforms and sensors of	5	v					v										

		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.																
48	Remote sensing of the earth	The purpose of the discipline is to master the methods of processing and analyzing satellite imagery data in solving cartographic, geodetic and environmental problems. Contents: Students will be able to understand the results of remote sensing of the Earth, use modern sensors operating in active and passive modes. They will master satellite imagery processing technology, including image enhancement and image interpretation methods, and learn how to select remote sensing data processing methods for solving geological and environmental problems.	6				v						v					
49	Basics of the cadastre	The purpose is to systematize and record information about real estate in a certain territory, create a unified database of land plots and real estate objects, their owners, restrictions and encumbrances. Content: to master the procedure for conducting cadastral activities that	5							v		v		v				

		allow you to fill out basic land cadastre documents. To study the regulatory framework, legal acts regulating the processes of cadastral activity.																	
50	Photogrammetry	To study the basics of the technology of modern photogrammetric processes, including methods for performing aerial surveys, their cameral processing, and analysis of the accuracy of the obtained materials, as well as methods for using them to create and update topographic maps and cadastral plans. Apply modern technologies and software products in solving land management and cadastral tasks, as well as perform the optimal choice of satellite imagery materials and their integration into GIS programs when creating cadastral maps.	5					v	v										
51	Space geodesy	A science that studies the use of the results of observations of artificial and natural satellites of the Earth to solve scientific and scientific-technical problems of geodesy. Creation of a global inertial reference frame based on space methods based on the position of extragalactic sources. Operational coordinate and time support of terrestrial objects by means of global navigation satellite systems. Coordinate-time support of space	5															v	v

		flights. The study of the shape of the Earth, Moon and planets using satellite measurements.																	
52	Geodetic observations of deformations of structures	Geodynamics as scientific discipline. Modern value of geodynamics at various scales of its use (global, regional, local). Contents: 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						
53	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 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	5														v	v

		observations to create satellite geodetic networks.																	
Cycle of profile disciplines Elective component																			
54	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 methods to solve geodetic problems. Contents: 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.	5		v			v		v									
55	Photogrammetric analysis and 3D modeling	Purpose: To create digital copies of objects for use in the field of architecture and urban planning, territorial planning and mapping. Prepare them for the processes of collecting and processing photogrammetric data and creating 3D models. Content: Processing of aerospace images, creation of realistic 3D models of objects using GIS technologies. Visualization of models in graphical programs. Formation of 3D point clouds from	5	v						v									

		the obtained images, analysis and processing of point cloud geometry.																
56	Artificial intelligence in geodesy and cartography	Goal: To develop students' knowledge and practical skills in applying artificial intelligence technologies to solve problems of processing, analyzing and visualizing geodetic and cartographic data. Introduction to artificial intelligence (AI). Machine learning and neural networks. And in the processing of geodetic data. AI in cartography. GIS and AI. Computer vision and remote sensing. Practical applications and projects	5															
57	Economics and management of cartographic production	The nature of the geographic data and the methods by which they are displayed on maps. 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.	5											**v**	**v**			
58	Economics and	To form an idea of the economics of	5											**v**	**v**			

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

5. Curriculum of the educational program

SATBAYEV UNIVERSITY

«APPROVED»
Decision of the Academic Council
NP JSC «KazNRTU
named after K.Satbayev»
dated 31.03.2025 Minutes № 12

WORKING CURRICULUM

Academic year	2025-2026 (Autumn, Spring)
Group of educational programs	B074 - "Urban planning, construction work and civil engineering"
Educational program	6B07314 - "Geodesy and cartography"
The awarded academic degree	Bachelor of engineering and technology
Form and duration of study	full time - 4 years

Discipline code	Name of disciplines	Block	Cycle	Total ECTS credits	Total hours	lek/lab/pr Contact hours	in hours SIS (including TSIS)	Form of control	Allocation of face-to-face training based on courses and semesters								Prerequisites
									1 course		2 course		3 course		4 course		
									1 sem	2 sem	3 sem	4 sem	5 sem	6 sem	7 sem	8 sem	
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)																	
M-1. Module of language training																	
LNG108	Foreign language		GED, RC	5	150	0/0/45	105	E	5								
LNG104	Kazakh (russian) language		GED, RC	5	150	0/0/45	105	E	5								
LNG108	Foreign language		GED, RC	5	150	0/0/45	105	E		5							
LNG104	Kazakh (russian) language		GED, RC	5	150	0/0/45	105	E		5							
M-2. Module of physical training																	
KFK101	Physical culture I		GED, RC	2	60	0/0/30	30	E	2								
KFK102	Physical culture II		GED, RC	2	60	0/0/30	30	E		2							
KFK103	Physical culture III		GED, RC	2	60	0/0/30	30	E			2						
KFK104	Physical culture IV		GED, RC	2	60	0/0/30	30	E				2					
M-3. Module of information technology																	
CSE677	Information and communication technology		GED, RC	5	150	30/15/0	105	E			5						
M-4. Module of socio-cultural development																	
HUM137	History of Kazakhstan		GED, RC	5	150	15/0/30	105	GE		5							
HUM134	Module of socio-political knowledge (cultural studies, psychology)		GED, RC	5	150	30/0/15	105	E			5						
HUM120	Module of socio-political knowledge (sociology, political science)		GED, RC	3	90	15/0/15	60	E			3						
HUM132	Philosophy		GED, RC	5	150	15/0/30	105	E				5					
M-5. Module of anti-corruption culture, ecology and life safety base																	
MNG564	Basics of Financial Literacy	1	GED, CCH	5	150	30/0/15	105	E				5					
MNG489	Fundamentals of economics and entrepreneurship	1	GED, CCH	5	150	30/0/15	105	E				5					
HUM111	Law basics	1	GED, CCH	5	150	15/0/30	105	E				5					
CYCLE OF BASIC DISCIPLINES (BD)																	
M-6. Module of physical and mathematical training																	
PHY468	Physics		BD, UC	5	150	15/15/15	105	E	5								
MAT101	Mathematics I		BD, UC	5	150	15/0/30	105	E	5								
MAT102	Mathematics II		BD, UC	5	150	15/0/30	105	E		5							MAT101
M-7. Module of basic training																	
GEN429	Engineering and computer graphics		BD, UC	5	150	15/0/30	105	E	5								

MAP570	Topographical graphics		BD, UC	3	90	0/0/30	60	E	3								
AAP418	Geodesy practical training		BD, UC	2				R		2							
MAP536	Geodesy		BD, UC	6	180	30/0/30	120	E		6							
MAP481	Geodetic instruments		BD, UC	5	150	15/0/30	105	E			5						
MAP474	Cartography		BD, UC	5	150	15/0/30	105	E			5						
MAP478	Theory of mathematical processing og geodetic measurements		BD, UC	5	150	15/0/30	105	E				5					
ELC893	Fundamentals of electronics and electrical engineering		BD, UC	4	120	15/15/15	75	E				4					
MAP477	Digital mapping		BD, UC	5	150	15/0/30	105	E					5				
MAP475	Engineering geodesy		BD, UC	5	150	15/0/30	105	E					5				
MAP114	Geoinformatics		BD, UC	5	150	15/0/30	105	E					5				CSE174
MAP479	Higher geodesy		BD, UC	5	150	15/0/30	105	E					5				
GED514	Hydrogeology and fundamentals of geology	1	BD, CCH	5	150	30/0/15	105	E					5				
GED646	Engineering Geology	1	BD, CCH	5	150	30/0/15	105	E					5				
PED122	Fundamentals of Scientific Research	1	BD, CCH	5	150	30/0/15	105	E					5				MAT103
HUM158	The basics of anti-corruption culture	1	BD, CCH	5	150	30/0/15	105	E					5				
MAP488	Organization and planning of topographic and geodetic works		BD, UC	5	150	15/0/30	105	E						5			
CIV582	Technology of building manufacture I	1	BD, CCH	5	150	30/0/15	105	E						5			
IDD427	Ecology and life safety	1	BD, CCH	5	150	30/0/15	105	E						5			
MAP480	Engineering surveying linear structures	1	BD, CCH	5	150	15/0/30	105	E						5			
CHE950	ESG principles in inclusive culture	2	BD, CCH	5	150	30/0/15	105	E						5			
MAP120	Engineering and geodetic surveys during construction	2	BD, CCH	5	150	15/0/30	105	E						5			MAP112
MAP555	Fundamentals of environmental mapping	3	BD, CCH	6	180	30/0/30	120	E						6			
MAP556	Basics of laser scanning	3	BD, CCH	6	180	30/0/30	120	E						6			
MAP482	Gravimetry		BD, UC	5	150	15/0/30	105	E							5		
MAP486	Geodetic works at industrial sites of mines and quarries	1	BD, CCH	5	150	15/0/30	105	E							5		
MNG563	Fundamentals of sustainable development and ESG projects in Kazakhstan	1	BD, CCH	5	150	30/0/15	105	E							5		
MAP561	Land law	1	BD, CCH	5	150	30/0/15	105	E							5		
MAP580	Web-GIS basics	2	BD, CCH	5	150	15/0/30	105	E							5		
MAP466	Web-cartography	2	BD, CCH	5	150	15/0/30	105	E							5		
MNG562	Legal regulation of intellectual property	2	BD, CCH	5	150	30/0/15	105	E							5		
MAP180	Landscape science	1	BD, CCH	5	150	15/0/30	105	E								5	
MAP181	Landscape Design	1	BD, CCH	5	150	30/0/15	105	E								5	
CYCLE OF PROFILE DISCIPLINES (PD)																	
M-8. Module of professional activity																	
MAP476	Basics of the cadastre		PD, UC	5	150	15/0/30	105	E			5						
MAP155	Photogrammetry		PD, UC	5	150	15/0/30	105	E				5					MAP112
AAP109	Industrial internship I		PD, UC	4				R				4					
MAP101	Automation of topographic and geodetic works		PD, UC	5	150	15/0/30	105	E					5				MAP112
AAP163	Industrial internship II		PD, UC	4				R						4			
MAP483	Aerospace survey methods		PD, UC	5	150	15/0/30	105	E						5			
MAP485	Global navigation satellite systems		PD, UC	5	150	15/0/30	105	E							5		
MAP125	Space geodesy		PD, UC	5	150	15/0/30	105	E							5		MAP105
MAP198	Fundamentals of digital photogrammetry	1	PD, CCH	5	150	15/0/30	105	E							5		MAP172
MAP581	Photogrammetric analysis and 3D modeling	1	PD, CCH	5	150	15/0/30	105	E							5		

MAP615	Artificial intelligence in geodesy and cartography	1	PD, CCH	5	150	15/0/30	105	E						5		
MAP614	Geodetic observations of deformations of structures		PD, UC	6	180	30/0/30	120	E							6	
MAP541	Remote sensing of the earth		PD, UC	6	180	30/0/30	120	E							6	
MAP543	Economics and management of cartographic production	1	PD, CCH	5	150	15/0/30	105	E							5	
MAP159	Economics and management of topogeodetic production	1	PD, CCH	5	150	15/0/30	105	E							5	MAP114, MAP112
M-9. Module of final attestation																
ECA103	Final examination		FA	8											8	
Additional type of training (ATT)																
AAP500	Military training															
Total based on UNIVERSITY:									30	30	30	30	30	30	30	
									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	0	5	56
BD	Cycle of basic disciplines	0	80	36	116
PD	Cycle of profile disciplines	0	50	10	60
Total for theoretical training:		**51**	**130**	**51**	**232**
FA	Final attestation				8
TOTAL:					**240**

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Minutes №5 dated 12.03.2025

Decision of the Academic Council of the Institute. Minutes №5 dated 23.01.2025

Signed:

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

Approved:

Vice Provost on academic development — Kalpeyeva Z. S.

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

Director - Mining and Metallurgical Institute named after O.A. Baikonurov — Ryabekov K. .

Department Chair - Surveying and geodesy — Meirambek G. .

Representative of the Academic Committee from Employers ___Acknowledged___ — Mukhametov Y.