НАО «КАЗАХСКИЙ НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ ТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ имени К.И.САТПАЕВА»

«Approved»
Director of MMI
_____ K.B. Rysbekov
«___» _____ 2025 y.

GRADUATE MODEL (Master's Degree)
Educational program

7M07306 – Geospatial Digital Engineering

Developed by
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Almaty 2025

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Introduction

The main idea of the educational program is to implement a continuous process of training scientific, pedagogical and professional personnel of a new generation capable of work aimed at transforming the new scientific potential of Kazakhstan from raw materials to innovation through the development of minerals and the implementation of sustainable trends in the mining industry.

The uniqueness of the OP "Geospatial Digital Engineering" is determined by the competencies possessed by a master who has been educated under this program.

The planning of the content of education, the way of organizing and conducting the educational process is carried out by the university and the scientific organization independently on the basis of the credit technology of training.

The Master's degree in scientific and pedagogical direction implements educational programs of postgraduate education for the training of scientific and scientific-pedagogical personnel for universities and scientific organizations with in-depth scientific-pedagogical and research training.

The content of the Master's degree program consists of:

1) theoretical training, including the study of cycles of basic and core disciplines;

2) practical training of undergraduates: various types of practices, scientific or professional internships;

3) research work, including the implementation of a master's thesis, - for a scientific and pedagogical master's degree

4) final certification.

The content of the OP "Geospatial digital Engineering" based on the development of a multi-level system of personnel training, the fundamental nature and quality of training, continuity and continuity of education and science, unity of training, education, research and innovation activities aimed at maximum satisfaction of consumer needs should ensure:

-obtaining a full-fledged and high-quality professional education in the field of mineral deposits development (MPI), confirmed by the level of knowledge and skills, skills and competencies, based on the criteria established by the State Educational Standard, their assessment, both in content and in volume:

- training of professional and competitive specialists in the field of geospatial digital engineering;

- creation of new technologies in the field of geodesy, cartography, geoinformatics and production management;

- ability to apply knowledge of mathematics, fundamental and technical sciences;

- using methods of analysis and evaluation of experimental results.

The specialist model provides for: competencies due to the development of

modern science and technology; competencies dictated by the requirements of the profession, specialty; competencies due to the socio-political system of the country, its spiritual and moral system.

The specialist model has historically been embodied in various forms: qualification characteristics and professionograms.

To acquire a complex of professional, intercultural, communicative competencies, a graduate must master the knowledge of a set of general education (OOD), basic (DB) and profile (PD) disciplines, both their mandatory component and the component of choice in accordance with the chosen trajectory of education in full, established by the state standard.

Of great importance in the modern world is the ability to navigate the information flow: the ability to find and systematize various sources of information according to a certain criterion; use rational methods of obtaining, converting, systematizing and storing information, actualize it in the necessary situations of intellectual and cognitive activity, as well as computer literacy, possession of modern technologies in the field of geodesy, cartography, geoinformatics and the ability to critically evaluate information.

1 Goals and objectives of the educational program 7M07306 – Geospatial digital engineering

Purpose: to train highly qualified scientific, technical and engineering personnel in the field of geodesy, geoinformatics, cartography, meeting the requirements of modern high-tech production, capable of carrying out design and production and technological activities in this field at a high technical level, to engage in organizational and managerial activities in the public and private sectors, in design, educational and scientific- research organizations of any form of ownership.

Tasks:

- modeling of processes and phenomena of geospatial digital engineering;
- development of methods for solving problems in geospatial digital engineering;
- organization and conduct of experiments, processing, generalization, analysis and registration of the results achieved;
- review of technical projects, inventions, scientific works; scientific and technical expertise of new methods and technical documentation of topographic and geodetic works and works related to remote sensing of territories;
- participation in professional pedagogical activity; study of the physical fields of the Earth and planets;
- implementation of high-precision measurements in the field of geodesy, astronomy, geodynamics and remote sensing;
- obtaining, processing, synthesis of geodetic, aerospace and other information for the purposes of mapping, research and production work;
- monitoring of natural resources, nature management, territories of technogenic risk;
- development of geoinformation systems at global, national, regional, local and municipal levels;
- creation of databases and data banks of digital topographic and geodetic and thematic information;
- introduction of multimedia, virtual, multidimensional digital spatial modeling technologies for making research and production and technological decisions;
- application of telecommunication and global satellite positioning systems in geoinformation systems, aerospace and geodetic works, monitoring;
- location determination and orientation by astronomical
- methods;
- development of normative and technical documents on the organization and conduct of topographic and geodetic works and works related to remote sensing of territories based on scientific research;
- development of methods and technical control, quality management of

topographic and geodetic, aerospace and photogrammetric products;

- preparation of projects for the production of topographic and geodetic works and works related to remote sensing of territories;
- management of the implementation of developed technical solutions and projects;
- participation in the development of technical specifications and research for the manufacture of geodetic instruments and systems for geodesy and remote sensing.
- develop, coordinate and approve regulatory documents regulating the procedure for performing cartographic and geodetic works, ensure compliance with the requirements of technical documentation for the production of works, applicable norms, rules and standards;
- develop and implement measures to improve and improve the technical level in the field of geospatial digital engineering, ensuring the competitiveness of the organization in modern economic conditions;
- organize your work and labor relations in a team based on modern methods, management principles, advanced production experience, technical, financial, social and personal factors;
- monitor, analyze and evaluate the actions of subordinates, manage a team of performers, including in emergency situations;
- provide training and certification of employees in the field of geospatial digital engineering;
- to carry out technical and economic analysis, comprehensively substantiate operational decisions taken and implemented, to seek
- opportunities to increase production efficiency, to assist in providing the company's divisions with the necessary technical data, regulatory documents, materials, equipment;
- to carry out work on the improvement of production activities, the development of projects and programs for the development of the enterprise (divisions of the enterprise);
- plan and carry out theoretical, experimental and laboratory studies, process the results obtained using modern information technologies;
- carry out patent search, study scientific and technical information, domestic and foreign experience on the subject of research;
- develop models of processes, phenomena, evaluate the reliability of the constructed models using modern methods and means of information analysis;
- make reports on research work independently or as part of creative teams;
- develop the necessary technical documentation as part of creative teams and independently.

2 List of qualifications and positions

A graduate in the specialty 7M07306 – Geospatial Digital Engineering is awarded the academic degree of Master of Technical Sciences.

Qualifications and positions are determined in accordance with the "Standard qualification characteristics of positions of teaching staff and persons equated to them" approved by the Order of the Ministry of Education and Science of the Republic of Kazakhstan dated July 13, 2009 No. 338 (with amendments and additions dated 06/09/2011)

Graduates of the specialty 7M07306 – Geospatial digital engineering, regardless of the training trajectory, can work in the following positions:

- Chief Surveyor;
- chief engineer cartographer;
- Director of geodetic, cartographic organizations
- Chief engineer in geodetic, cartographic organizations
- Designer
- Teacher
- Scientific worker

Types of professional activity

The peculiarity of this master's program is the training of graduates who are able to conduct the following types of professional activities:

- research activities;
- scientific and production activities;
- project activities;
- scientific and pedagogical activity.

Objects of professional activity

The objects of professional activity of students in the specialty "Geospatial digital Engineering" are the surface of the Earth, other planets and their satellites, territorial and administrative formations, artificial and natural objects on the surface and inside the Earth and other planets, as well as near-Earth outer space, geodynamic phenomena and processes, gravitational, electromagnetic and other physical fields, cartographic works (different in subject, content, scale, purpose, use of maps, atlases, globes, aero- and satellite images and satellite photos, etc.) on paper and electronic media.

3. Descriptors

The requirements for the master's degree level are determined on the basis of the Dublin descriptors of the second level of higher education (Master's degree) and reflect the acquired competencies expressed in the achieved learning outcomes.

Learning outcomes are formulated both at the level of the entire master's degree program, and at the level of individual modules or academic discipline.

Descriptors reflect the learning outcomes that characterize the student's

abilities:

1. demonstrate developing knowledge and remembrance in the studied areas of geospatial digital engineering based on advanced knowledge of this field, in the development and application of ideas in the context of research;

2. apply at a professional level their knowledge, understanding and abilities to solve problems in a new environment, in a broader interdisciplinary context;

3. to collect and interpret information to form judgments taking into account social, ethnic and scientific considerations;

4. clearly and unambiguously communicate information, ideas, conclusions, problems and their solutions;

5. learning skills necessary for independent continuation of further education in the studied field of geospatial digital engineering.

4. Competencies upon completion of training

4.1 Requirements for the key competencies of graduates of the scientific and pedagogical Master's degree, must:

1) to have

about the role of science and education in public life;

about current trends in the development of scientific knowledge;

about actual methodological and philosophical problems of natural (social, humanitarian, economic) sciences;

about the professional competence of a high school teacher;

about contradictions and socio-economic consequences of globalization processes;

2) know:

the methodology of scientific knowledge;

principles and structure of the organization of scientific activity;

psychology of cognitive activity of students in

the learning process;

psychological methods and means of improving

the effectiveness and quality of training;

3) be able to:

use the acquired knowledge for the original development and application of ideas in the context of scientific research;

critically analyze existing concepts, theories and approaches to the analysis of processes and phenomena;

integrate knowledge gained in different disciplines to solve research problems in new unfamiliar conditions;

by integrating knowledge to make judgments and make decisions based on incomplete or limited information;

apply the knowledge of pedagogy and psychology of higher education in their teaching activities;

apply interactive teaching methods;

to carry out information-analytical and information bibliographic work with the involvement of modern information technologies;

think creatively and creatively approach the solution of new problems and situations;

be fluent in a foreign language at a professional level, which allows conducting scientific research and teaching special disciplines in universities;

summarize the results of research and analytical work in the form of a dissertation, a scientific article, a report, an analytical note, etc.;

4) have the skills of:

research activities, solving standard scientific problems;

implementation of educational and pedagogical activities on credit technology of training;

methods of teaching professional disciplines;

the use of modern information technologies in the educational process;

professional communication and intercultural communication;

public speaking, correct and logical design of their

thoughts in oral and written form;

expanding and deepening the knowledge necessary for daily professional activities and continuing education in doctoral studies.

5) be competent:

in the field of research methodology;

in the field of scientific and scientific-pedagogical activity in higher educational institutions;

in matters of modern educational technologies;

in the implementation of scientific projects and research in the professional field;

in ways to ensure constant updating of knowledge, expansion of professional skills and abilities.

B - Basic knowledge, skills and abilities

B1- knowledge of the basic methods, methods for the development of plans and programs for the organization of innovative activities at the enterprise and the understanding of economic efficiency using professional automated systems. Make optimal management decisions;

B2 - understanding and application of the concept of geospatial analysis, immersive technologies and 3D visualization of the results of aerospace and ground survey methods;

BZ is the ability to solve standard tasks in the field of geospatial digital engineering using innovative technologies.

P - Professional competencies, including according to the requirements of industry professional standards, providing deep theoretical knowledge and practical skills in the field of geospatial digital engineering.

P1 - A wide range of theoretical and practical knowledge in the professional

field, production technology of geodetic, cartographic, cadastral, land management works.

P2 - Possess theoretical and practical skills, perform professional functions in the tasks of rational production of geodetic measurements, including justification of the type and type of geodetic instruments and equipment, their control in accordance with IOS standards.

PZ - Possess theoretical and practical skills in conducting geodetic surveys to solve applied and scientific problems.

P4 - Be able to analyze and apply modern computer technologies, including Web-based GIS for creating database management systems, analyzing mathematical processing methods, the ability to show creative initiative, prepare applications for inventions and industrial designs.

P5 - To understand the trends in the development of technologies for digitalization of geostationary data, the readiness to transform processes in the conditions of dynamic changes in processes in the production market, to apply modern technologies for visualization and optimization of production processes, big data management in the field of technologies for process automation.

P6 - Willingness to participate in the implementation of automated production management systems in the field of geodesy and cartography

P7 - Apply the skills of management systems, means of increasing production efficiency and adaptation of modern information technologies.

P8 - Knowledge of the legislative foundations in the field of geodesy, cartography, spatial data.

P9 - The ability to perform marketing research, conduct economic cost analysis for the implementation of processes in the field of geospatial digital engineering.

P10 - Willingness to participate in the research of objects of professional activity and their structural elements;

P11 - Be able to study and use scientific and technical information in the field of geodesy, cartography, geoinformatics, spatial data.

P12 - Willingness to perform scientific and laboratory research, interpret the results obtained, compile and defend reports;

P13 — Proficiency in the organization of scientific research.

P14 —Readiness to develop innovative design solutions in the field of geospatial digital engineering;

P15 — The ability to develop the necessary technical and regulatory documentation as part of creative teams and independently, to control the compliance of projects with the requirements of standards, specifications and documents in the field of geospatial digital engineering.

P16 – Readiness to develop, coordinate and approve, in accordance with the established procedure, technical, methodological and other documents regulating the procedure, quality and safety of geodetic and cartographic work.

P17 - Skills in conducting scientific research, performing laboratory and

experimental studies with subsequent processing of results using modern computer technologies, improving existing and developing new research methods and techniques, technical and technological solutions and hardware for their implementation, choosing technical means for conducting research.

P18 - The ability to analyze and apply the law on geodesy, cartography and spatial data at work and regularly monitor changes and additions to these laws.

0 - Universal, social and ethical competencies

01 - Ability to abstract thinking, analysis, synthesis;

02 - The ability to use the basics of philosophical knowledge to form a worldview position;

03 - The ability to analyze the main stages and patterns of the historical development of society for the formation of a civic position;

04 - The ability to use the basics of economic knowledge in various spheres of life;

05 -Ability to use the basics of legal knowledge in various spheres of life;

06 - Willingness to act in non-standard situations, to bear social and ethical responsibility for the decisions made;

07 - Readiness for self-development, self-realization, use of creative potential;

08 - The ability to use methods and means of physical culture to ensure full-fledged social and professional activities;

09 - The ability to use first aid techniques, methods of protection in emergency situations.

C - Special and managerial competencies:

C1 - The ability to solve the tasks of professional activity on the basis of information and bibliographic culture with the use of information and communication technologies and taking into account the basic requirements of information security;

C2 - Readiness for communication in oral and written forms in the state, Russian and foreign languages to solve the tasks of professional activity;

SZ - Willingness to lead a team in the field of their professional activities, to perceive social, ethnic, confessional and cultural differences with tolerance;

C4 - The ability to use software products for processing information arrays;

C5 - Knowledge of methods of digital modeling of spatial systems in the implementation of interdisciplinary educational and research projects

C6 - Demonstration of readiness for independent research work in the field of cartographic design and forecasting based on modern digital programs.

C7 – The ability to apply information technologies to solve national applied cartography problems, monitoring the development of regional spatial systems.

C8 – Readiness to use Earth remote sensing data for the analysis of research objects by means of computer technology.

4. 2 Requirements for the research work of a master's student in the scientific and pedagogical magistracy

1) corresponds to the profile of the master's degree program, according to which the master's thesis is being performed and defended;

2) relevant and contains scientific novelty and practical significance;

3) based on modern theoretical, methodological and technological achievements of science and practice;

4) performed using modern methods of scientific research;

5) contains research (methodological, practical) sections on the main protected provisions;

6) based on the best international experience in the relevant field of knowledge.

4.3 Requirements for the organization of practices

The educational program of the scientific and pedagogical Master's degree includes two types of practices that are conducted in parallel with theoretical training or in a separate period:

1) pedagogical in the DB cycle - at the university;

2) research in the PD cycle - at the place of completion of the dissertation.

Pedagogical practice is conducted in order to form practical skills of teaching and learning methods. At the same time, undergraduates are involved in conducting undergraduate classes at the discretion of the university.

The research practice of a master's student is conducted in order to familiarize with the latest theoretical, methodological and technological achievements of domestic and foreign science, modern methods of scientific research, processing and interpretation of experimental data.

5 Requirements for completing studies and obtaining a diploma

The main criterion for the completion of the educational process for the preparation of masters of technical sciences is the development of at least 120 credits by a master's student, of which at least 73 credits of theoretical training, at least 12 credits of pedagogical and research practice and at least 24 credits of research work of a master's student.

Degree/qualifications awarded: The graduate of this educational program is awarded the academic degree "Master of Technical Sciences".

A graduate who has mastered master's degree programs must have the following general professional competencies:

the ability to independently acquire, comprehend, structure and use new knowledge and skills in professional activities, develop their innovative abilities;

the ability to independently formulate research goals, establish the sequence of solving professional tasks;

the ability to apply in practice the knowledge of fundamental and applied sections of disciplines that determine the orientation (profile) of the master's degree program;

the ability to professionally choose and creatively use modern scientific and technical equipment to solve scientific and practical problems;

the ability to critically analyze, present, defend, discuss and disseminate the results of their professional activities;

proficiency in the preparation and execution of scientific and technical documentation, scientific reports, reviews, reports and articles;

willingness to lead a team in the field of their professional activities, tolerantly perceiving social, ethnic, confessional and cultural differences;

willingness to communicate orally and in writing in a foreign language to solve the tasks of professional activity.

A graduate who has mastered the master's degree program must have professional competencies corresponding to the types of professional activities that the master's degree program is focused on:

Research activities:

-the ability to form diagnostic solutions to professional problems by integrating the fundamental sections of sciences and specialized knowledge obtained during the development of the master's degree program;

-the ability to independently conduct scientific experiments and research in the professional field, generalize and analyze experimental information, draw conclusions, formulate conclusions and recommendations;

-the ability to create and explore models of the studied objects based on the use of in-depth theoretical and practical knowledge in the field of geospatial digital engineering, capable of implementing their professional knowledge, skills and abilities in public and private management, in design and research organizations of any form;

Scientific and production activities:

-the ability to independently carry out production and scientific-production field, laboratory and interpretation work in solving practical problems in the field of geodesy, cartography, geoinformatics;

-the ability to professionally operate modern field and laboratory equipment and devices in the field of the master's degree program;

-the ability to use modern methods of processing and interpreting complex information to solve scientific and industrial problems;

Project activities:

-the ability to independently draw up and submit projects of research and scientific-production works;

-readiness to design complex research and scientific-production works in solving professional tasks;

Organizational and managerial activities:

-readiness to use practical skills of organization and management of research

and scientific-production works in solving professional tasks;

-readiness for the practical use of regulatory documents in the planning and organization of scientific and production work.

Scientific and pedagogical activity:

-the ability to conduct seminars, laboratory and practical classes;

-the ability to participate in the management of scientific and educational work of students in the field of geodesy, cartography, geoinformatics.

When developing a master's degree program, all general cultural and general professional competencies, as well as professional competencies related to those types of professional activities that the master's program is focused on, are included in the set of required results of mastering the master's program.

Change registration sheet to _____

Sequence number	Section, item	Type of change (replace, cancel, Add)	Number and date of notification	The change has been made	
				Date	SNP Signature, position