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

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

GRADUATE MODEL (PhD)
of the educational program in

8D07309 Geomatics, geodesy and geospatial sciences

Developed by
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Table of contents

Introduction

In the international educational space, the leading conceptual model for PhD training is outcome-based education, which implies the implementation of a competency-based approach to learning.

One of the key learning outcomes of the doctoral program 8D07309 – "Geomatics, Geodesy and Geospatial Sciences" is the acquisition of knowledge, skills, and abilities necessary for conducting scientific research and solving applied problems using advanced geospatial technologies, including artificial intelligence and geographic information systems (GIS).

A Doctor of Philosophy (PhD) should be prepared for independent professional activity in the fields of geomatics, geodesy, and geospatial sciences, combining deep theoretical training with practical skills in digital technologies.

The planning of educational content, methods of organizing, and conducting the learning process is carried out by the university and the research institution based on the credit-based learning system.

The content of the doctoral educational program includes:

- Theoretical training (basic and specialized disciplines);
- Practical training (internships and scientific placements);
- Research work (including dissertation work and final attestation).

The content of the educational program "Geomatics, Geodesy and Geospatial Sciences" is based on the development of a multi-level system of human resource training, academic rigor and quality of education, continuity and integration of education and science, unity of education, upbringing, research, and innovation activities. It is aimed at meeting the needs of consumers to the fullest extent and must ensure:

- The training of highly qualified and competitive professionals in the field of geospatial digital engineering;
- The development of new technologies in geodesy, cartography, geoinformatics, and production management;
- The ability to apply knowledge in mathematics, fundamental and technical sciences;
- The use of methods for analyzing and evaluating the results of experiments.

The specialist model includes: competencies driven by the advancement of modern science and technology; competencies dictated by the requirements of the profession and specialty; and competencies influenced by the socio-political system of the country and its spiritual and moral values.

To acquire a set of professional, intercultural, and communicative competencies, a graduate must master knowledge across a range of general education (GED), basic (BD), and specialized (SD) disciplines, including both mandatory and elective components according to the chosen educational trajectory, in the full scope established by the state standard.

In the modern world, the ability to navigate information flow is of great importance: the ability to find and systematize various sources of information

based on specific criteria; to use efficient methods for obtaining, transforming, organizing, and storing information; to apply it in relevant situations of intellectual and cognitive activity; to possess modern technologies in the field of geospatial digital engineering, geodesy, cartography, and geoinformatics; and to critically evaluate information.

1 Goals and objectives of the educational program 8D07309 – Geomatics, geodesy and geospatial sciences

Objective:

To train highly qualified specialists capable of developing and implementing innovative methods and approaches, including artificial intelligence and geographic information systems, to solve scientific and applied problems in industrial and research practice.

Tasks of the educational program:

- Preparedness for research and project activities in the fields of geodesy, cartography, and geoinformatics, including the development of new methods in accordance with research objectives.
- Ability to develop and implement technologies and methods of geospatial analysis at local and global levels.
- Ability to find and systematize new information necessary for solving professional tasks and actively participate in the work of organizations.
- Proficiency in scientific, informational, and ideological communication; ability to justify one’s position and carry out management and service functions.
- Capacity for self-learning and continuous professional development.
- Skills in analyzing scientific publications and preparing original research in a foreign language.
- Awareness of modern approaches, methods, and development trends in geospatial sciences.

2 List of qualifications and job positions

Graduates of the specialty 8D07309 – "Geomatics, Geodesy and Geospatial Sciences" are awarded the Doctor of Philosophy (PhD) degree in the field after successfully defending their doctoral dissertation.

Qualifications and positions are defined in accordance with the National Qualifications Framework (NQF), approved by the minutes of the Republican Tripartite Commission on Social Partnership and Regulation of Social and Labor Relations dated March 16, 2016.

Graduates of the 8D07309 – "Geomatics, Geodesy and Geospatial Sciences" program, regardless of the educational path chosen, may hold the following positions:

- Chief Surveyor;
- Chief Cartographic Engineer;
- Director of a Cartographic Factory;
- Chief Engineer of a Cartographic Factory;
- Design Engineer;

- Educator, University Lecturer;
- Education Manager;
- Researcher

Types of Professional Activities

A distinctive feature of this program is the preparation of graduates capable of engaging in the following types of professional activities:

- Scientific research;
- Scientific and industrial activities;
- Design and engineering work;
- Scientific and pedagogical activities

Objects of Professional Activity

The objects of professional activity for students specializing in Geomatics, geodesy and geospatial sciences include the Earth's surface, other planets, and their satellites; territorial and administrative entities; artificial and natural objects on and beneath the Earth's surface and that of other planets; near-Earth outer space; geodynamic phenomena and processes; gravitational, electromagnetic, and other physical fields; cartographic products (maps, atlases, globes, aerial and satellite imagery, space photomaps, etc.) of various themes, contents, scale, purpose, and usage, presented on both paper and digital media.

3. Descriptors

The requirements for the level of doctoral training are based on the Dublin Descriptors for the second level of higher education (Master's level) and reflect the acquired competencies, as expressed through achieved learning outcomes.

Learning outcomes are formulated both at the level of the entire doctoral educational program and at the level of individual modules or academic disciplines.

The descriptors reflect the learning outcomes that characterize the learner's ability to:

1. Demonstrate advanced knowledge and understanding in the field of geospatial digital engineering, based on the latest scientific achievements, and apply this knowledge creatively in the context of research and innovation.
2. Apply knowledge, understanding, and problem-solving skills at a professional level in new or unfamiliar environments, within broader interdisciplinary contexts.
3. Collect and interpret data to make informed judgments, taking into account relevant social, ethical, and scientific considerations.
4. Clearly and unambiguously communicate information, ideas, conclusions, problems, and their solutions to both specialist and non-specialist audiences.
5. Possess learning skills necessary for independent and self-directed

continuing education in the field of geospatial digital engineering.

4. Competencies upon completion of studies

4.1 Requirements for key competencies of doctoral graduates:

A doctoral graduate must have an understanding of

- the professional competencies of a higher education instructor;
- the contradictions and socio-economic consequences of globalization processes;

Know:

- the principles and structure of scientific activity;
- the psychology of students' cognitive activity in the learning process;
- psychological methods and tools for improving the effectiveness and quality of education;

Be able to:

- integrate knowledge acquired across different disciplines to solve research problems in new and unfamiliar conditions;
- make judgments and decisions based on incomplete or limited information through knowledge integration;
- apply knowledge of pedagogy and psychology of higher education in their teaching practice;
- think creatively and approach new problems and situations with innovation;
- be fluent in a foreign language at a professional level sufficient for conducting research and teaching specialized subjects at universities;

Possess skills in:

- professional communication and intercultural interaction;
- public speaking and clearly structuring thoughts in oral and written form;

Be competent in:

- modern educational technologies;
- conducting scientific projects and research in their professional field;
- methods for continuous knowledge updating, and expanding professional skills and abilities.

B – Basic Knowledge, Skills, and Abilities

B1 – Analyze current trends in modern science, identify promising directions of research in the subject area, determine the composition of research work and influencing factors.

B2 – Apply advanced knowledge in the professional subject area that reflects the current level of scientific development.

P – Professional Competencies

P1 – Use mathematical, numerical, and computer modeling methods to analyze and solve applied and engineering-technical problems, demonstrating the ability to expand knowledge through digital and educational technologies.

P2 – Apply a mathematical-statistical approach to spatial problems, including the use of GIS and data processing software packages.

P3 – Navigate modern approaches, methods, and tools for studying the figure and external gravitational field of the Earth and other planets, as well as trends and development paths of these methods.

P4 – Analyze scientific publications and present results of one's own research in writing, in accordance with established academic norms, in a foreign language.

P5 – Understand trends in geospatial data digitalization technologies, demonstrate readiness for process transformation in dynamic market conditions, apply modern technologies for visualization and optimization of production processes, manage big data in automation technologies.

P6 – Be knowledgeable in legislative frameworks in geodesy, cartography, and spatial data.

P7 – Possess skills in organizing scientific research.

P8 – Be prepared to develop, coordinate, and approve technical, methodological, and other documents regulating the procedure, quality, and safety of geodetic and cartographic work.

P9 – Be able to analyze and apply the law on geodesy, cartography, and spatial data in practice and regularly monitor changes and amendments to such laws.

G – General Human, Social, and Ethical Competencies

G1 – Ability for abstract thinking, analysis, and synthesis.

G2 – Ability to use basic philosophical knowledge to form a worldview.

G3 – Ability to analyze key stages and patterns of historical development to shape civic awareness.

G4 – Ability to apply basic economic knowledge in various life spheres.

G5 – Ability to use legal knowledge in different areas of life.

G6 – Readiness to act in non-standard situations, bear social and ethical responsibility for decisions made.

G7 – Readiness for self-development, self-realization, and use of creative potential.

G8 – Ability to use physical culture methods for effective social and professional activity.

G9 – Ability to apply first aid techniques and protection methods in emergency situations.

S – Special and Managerial Competencies

S2 – Readiness to communicate orally and in writing in Kazakh, Russian, and foreign languages to solve professional tasks.

S3 – Readiness to lead a team in one's professional field, with tolerance toward social, ethnic, religious, and cultural differences.

S4 – Ability to use software tools for processing information arrays.

S5 – Proficiency in digital modeling methods for spatial systems in interdisciplinary educational and scientific projects.

S7 – Ability to use information technologies to solve national applied

problems in cartography and regional spatial system monitoring.

4. 2 Requirements for Doctoral Research Work (DRW)

1) The research topic must correspond to the main issue addressed in the doctoral dissertation.
2) It must be relevant and contain scientific novelty and practical significance.
3) It should be based on modern theoretical, methodological, and technological achievements in science and practice.
4) It must be carried out using modern methods of scientific research.
5) It should include research (methodological, practical) sections related to the main defended provisions.

Requirements for Internship Organization

The educational program 8D07309 – "Geomatics, Geodesy and Geospatial Sciences" includes two types of internships: industrial and research.

The teaching internship is conducted to develop practical skills in teaching methodology and instruction. Doctoral students are involved in conducting undergraduate and graduate classes at the discretion of the university.

The research internship is aimed at studying theoretical, methodological, and technological advancements in both national and international science, modern scientific research methods, and the processing and interpretation of experimental data within the framework of the dissertation research.

5 Requirements for Graduation and Diploma Award

The main criterion for the completion of the educational process in doctoral training is the fulfillment of the doctoral educational program and the successful defense of the doctoral dissertation.

Individuals who have fully met the above requirements are awarded a university diploma conferring the Doctor of Philosophy degree and an academic transcript.

The learning outcomes of the educational program 8D07309 – "Geomatics, Geodesy and Geospatial Sciences" are as follows:

1) Analyze trends in modern science, determine promising directions of scientific research in the professional field, and define the scope and influencing factors of research activities.

2) Apply methods of mathematical, numerical, and computer modeling in the analysis and solution of applied and engineering problems, demonstrating proficiency in expanding knowledge through information and educational technologies.

3) Acquire advanced knowledge in the subject area of professional activity, reflecting the current level of scientific development.

4) Form a conceptual worldview of a future scientist in terms of understanding the spatial aspects of the environment when making professional and/or managerial decisions.

5) Apply mathematical and statistical approaches to spatial problems, including methods from geographic information systems (GIS) and statistical data processing tools.

6) Navigate modern approaches, methods, and tools for studying the figure and external gravitational field of the Earth and other planets, as well as the trends and directions of method development in this area.

7) Analyze scientific publications and present the results of one’s own research in written form in accordance with accepted academic standards in a foreign language.

Amendment registration sheet _____

Serial No.	Section, Clause	Type of Change (replace, cancel, add)	Notice No. and Date	Change Entered	
				Date	Full Name