K.Turysov Institute of Geology and Oil and Gas Engineering
Department of "Geophysics and Seismology"

EDUCATIONAL PROGRAM
7M07147 – "Digital (exploration) Geophysics"

Code and classification of the field of education: **7M07 "Engineering, manufacturing and construction industries"**

Code and classification of training areas: **7M071 "Engineering and Engineering"**

Group of educational programs: **M109 "Petroleum and ore Geophysics"**

NRK Level: 7
ORC Level: 7
Duration of study: 1,5 years
Volume of credits: 90

Almaty 2025

The educational program 7M – "Digital (exploration) Geophysics" was approved at a meeting of the Scientific Council of the National Academy of Sciences of KazNTU named after K.I.Satpayev.

Protocol № 9, «20» February 2025 y.

Reviewed and recommended for approval at a meeting of the Educational and Methodological Council of the National Academy of Sciences of Kazntu named after K.I.Satpayev.

Protocol № 4 «3» February 2025 y.

The educational program 7M – "Digital (exploration) Geophysics" was developed by the academic committee in the field of training: 7M071 - "Engineering and Engineering"

Full name	**Academic degree/ academic title**	**Position**	**Workplace**	**Signature**
Chairman of the Academic Committee:				
Istekova Sara amanzholovna	Doctor of Geological and Mineralogical Sciences	Professor	NJSC "Kazakh National Research Technical University named after K.I.Satpayev"	
Teaching staff:				
Ratov Boranbay Tovbasarovich	Doctor of Technical Sciences	Head of the Department of "Geophysics and Seismology "	NJSC "Kazakh National Research Technical University named after K.I.Satpayev"	
Abetov Auez Egemberlyevich	Doctor of Geological and Mineralogical Sciences	Professor	NJSC "Kazakh National Research Technical University named after K.I.Satpayev"	
Umirova Gulzada Kubashevna	Doctor of PhD	Associate Professor	NJSC "Kazakh National Research Technical University named after K.I.Satpayev"	
Togizov Kuanysh Serikkhanovich	Doctor of PhD	Professor	NJSC "Kazakh National Research Technical University named after K.I.Satpayev"	

Aliakbar Madiyar Manarbekuly	Master of Technical Sciences	Senior lecturer	NJSC "Kazakh National Research Technical University named after K.I.Satpayev"	
Employers:				
Khitrov Dmitry Mikhailovich	Candidate of Technical Sciences	Manager of the company's data processing center	«PGS Kazakhstan LLP»	
Kurmanov Baurzhan Koptleuovich	Master of Technical Sciences	General manager	OPTIMUM Design Institute LLP	
Students				
Daurbayeva Gulbanu Khamitovna	Master of Technical Sciences	1st year doctoral student	NJSC "Kazakh National Research Technical University named after K.I.Satpayev"	
Muzapparova Akerke Bakbergenovna	Master of Technical Sciences	1st year doctoral student	NJSC "Kazakh National Research Technical University named after K.I.Satpayev"	
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List of abbreviations and designations

NPJC KazNTU named after K.I.Satpayev - Non-Profit Joint Stock Company Kazakh National Research Technical University named after K.I.Satpayev;
GOSO – The State mandatory standard of education of the Republic of Kazakhstan;
Ministry of Education and Science of the Republic of Kazakhstan – Ministry of Science and Higher Education of the Republic of Kazakhstan;
OP – educational program;
University – higher education institution;
NRK – National Qualifications Framework;
Research and development–scientific and research work;
O – universal, socio-ethical competencies
ORC – Industry Qualifications Framework;
PC – professional competencies;
Teaching staff – teaching staff;
Russian Academy of Sciences – Republican Academy of Sciences of the Russian Federation;
RO – learning outcomes of the educational program;
C – special and managerial competencies.
JSC – joint stock company;
LLP is a limited liability partnership.
CO - competence training;
SRO (SRS, SRM, SRD) – independent work of the student;
SROP (SRSP, SRMP, SRDP) – independent work of a student with a teacher;
RUP – working curriculum
IUP – individual curriculum
DB-basic discipline;
PD is a profiling discipline;
VK- University component;
KV Component of choice;
IA-final certification;

1. Description of the educational program

The educational program of the profile master's degree 7M07147 – "Digital (exploration) Geophysics" was developed within the framework of the training area 7M071 "Engineering and Engineering" and focuses on deepening the professional training of production workers in the application of modern digital technologies and analytical methods for studying and evaluating geophysical data. The specialized Master's degree (1.5 years) provides in-depth professional training, and the training is of an applied nature. It is aimed not only at developing management skills in all areas of geophysical activity, but also at training professional managers and managers.

The program covers areas such as processing and analyzing geophysical signals, modeling underground structures, geographic information systems (GIS), and using machine learning algorithms to interpret geophysical research. Undergraduates will master software tools for data processing, methods of geophysical modeling, and will also learn how to apply the results of exploration research in various branches of mining and exploration.

The training includes theoretical classes, laboratory work and research projects, which will ensure the practical application of the acquired knowledge. Graduates of the program will be prepared to work in both scientific and industrial fields, and will also be able to continue their educational trajectory in doctoral studies.

The Master's degree program (1.5 years) for training in the field of 7M07147 – "Digital (exploration) Geophysics" provides: a) in-depth training of specialists in the field of physico-geological foundations of geophysical methods, digital data recording technologies and their application in the search and exploration of minerals; b) obtaining high-quality knowledge by undergraduates in the processing, modeling of geophysical processes and geological interpretation of geophysical data using modern digital software; c) undergraduates gain knowledge and modern ideas about statistical methods and machine learning for analyzing and processing large volumes of geophysical data; d) students acquire a set of knowledge on the use of geographic information systems (GIS) for visualization, integration of geophysical data with other geoscientific data and analysis of the results.

The program includes training in modern computer programs Storm, Petrel, Eclipse, Surfer, Geosoft, Geolog-Focus, Echos-Gold, Geoplatt.

Professors from leading universities near and far abroad, experts from manufacturing companies and research institutes are invited to conduct lectures and consultations on modern problems of oil and gas and ore geophysics.

The program includes both theoretical classes and practical laboratory work. Students will have the opportunity to participate in field research and internships at leading geophysical companies.

Undergraduates practice at research institutes (Institute of Geophysics of the Ministry of Education and Science of the Republic of Kazakhstan, K. I. Institute of Geological Sciences). Satpayeva, KazNIPImunaygas, operator and service companies Karachaganak Petroleum Operating, Tengizchevroil, Kazgeologiya,

PGD Services, DANK, PGS, NPC Geoken, Geo Energi Group, TatArka, Kazakstankaspiyshelf, Kazakh Geophysical Company, Batys Geofizservice, GIS Company, Azimut Energy Services, Kazakhmys, Alstron LLP, Azimut Geologiya LLP, Anega Kazakhstan LLP, Volgogeologiya-Geotechnocenter JSC, GIS LLP, DP Ortalyk LLP, Zhanros Drilling LLP", Izdenis LLP, Karakudukmunai LLP, Karazhanbasmunai JSC, KazGIIZ LLP, Kazakhoil Aktobe LLP, Kyzylkum LLP, KOR Oil Company JSC, Uzenpromgeofizika JSC, JV KATKO LLP, KazMunayGas JSC, PetroKazakhstan JSC, Bapy Mining LLP, KAZ Minerals PLS NAC KazAtomProm JSC, MMC Kazakhaltyn JSC, GEO ENERGY GROUP LLPand others .

The best undergraduates can receive additional education under the academic mobility program at the Colorado School of Mines (USA), Moscow State University, Tomsk Polytechnic University, Friye University, Lorrain University (Nancy, France), Institute of Mining Engineering and Technology (Beijing, China), Adam Mickiewicz University (Poland), University of Warsaw (Poland), Bergakademie Freiberg (Germany), Vrije Universiteit Brussels (Belgium), Natural History Museum (London, UK) and other universities.

Graduates receive a Master's degree in Engineering and Technology and work in oil and gas and mining companies in engineering positions, and in research institutes as researchers. The profession in the field of geophysics has many positive aspects:

1. There is a high demand for specialists and a variety of career opportunities, as geophysics is a key area for mining, energy and the environment, which creates a steady demand for qualified production workers;

2. Innovative technologies: Work in geophysics is often associated with the use of modern technologies and methods such as seismic exploration, GPR systems and computer modeling, which makes the profession interesting and dynamic.

3. Contribution to sustainable development: Geophysicists play an important role in assessing and minimizing environmental impacts, which contributes to sustainable development and nature conservation.

4. Interdisciplinary approach: Geophysics combines elements of physics, mathematics, geology and engineering, which allows specialists to develop a wide range of skills and knowledge.

5. International career opportunities: geophysicists can work in different countries and regions, which opens up opportunities for travel and cultural exchange.

6. Competitive salaries: Geophysics specialists often earn high salaries, especially in the oil and gas sector and when working for international companies.

These aspects make the profession of geophysics attractive to many students and specialists.

Area of professional activity:

Study of the structure and material composition of the sedimentary cover and lithosphere of the Earth, geophysical prospecting, exploration and forecast of mineral deposits, detailed geological and geophysical study of the structure of oil and gas bearing areas and specific deposits, ore regions and deposits of solid

minerals; surface and borehole geophysical studies at the stage of exploration and additional exploration; geophysical monitoring of the geological environment of exploited deposits mineral resources.

The professional activity of masters can be carried out in: academic and departmental research organizations related to solving geological problems; geological organizations, exploration and mining companies and companies engaged in prospecting, exploration and extraction of mineral raw materials; organizations monitoring the environment and engaged in solving environmental problems; work as a consultant for companies engaged in exploration and production of resources, as well as project management in the field of geophysical research.

Objects of professional activity:

The upper part of the Earth's crust, rocks and mineral resources; accumulations of hydrocarbons and deposits of solid minerals; geophysical fields; natural and man-made geological processes in the areas of exploited mineral deposits, physico-geological models of formations, sections, mineral deposits in the process of their exploration and development; computerized and software-controlled information and measurement systems and processing systems and complexes.

The subjects of professional activity are:

Study of the structure of the Earth's crust, physical models of the Earth's crust and physical properties of rocks; conducting scientific research in the field of geoelectric, seismic, gravimagnetic and nuclear geophysical methods, as well as borehole geophysical observations; conducting field observations, processing, interpretation and modeling of the data obtained in the study of geological objects, as well as measures to ensure safety during geophysical works and reducing their anthropogenic impact on the environment.

The areas of professional activity of the master in the relevant field are:

- organizational and technological; settlement and design; service and operational; production and technological activities in:
- The Ministry of Energy and the Ministry of Industry and Infrastructure Development of the Republic of Kazakhstan;
- academic and departmental research organizations related to solving geological problems;
- operator and service companies engaged in geological exploration for prospecting, exploration and additional exploration of mineral deposits, as well as overseeing the development of these deposits;
- organizations related to environmental monitoring and solving environmental problems.

Types of professional activity:

Masters in the field of Digital (exploration) Geophysics are preparing for the implementation of scientific research and scientific production professional activities. In accordance with the theoretical and professional training they have received, they can perform the following types of activities:

a) organizational and managerial activities:

- planning, organization and management of scientific research and scientific production field, laboratory and interpretive geological and geophysical work;

- development of operational work plans for geophysical parties and detachments;

- selection and justification of scientific, technical and organizational solutions based on geological and geophysical data and economic calculations.

- planning and organization of scientific and industrial seminars and conferences.

b) scientific and research activities:

- independent selection and justification of the goals and objectives of geological and geophysical scientific research;

- independent selection and development of methods for solving assigned tasks during field, laboratory, and interpretive work using modern geophysical equipment, digital devices, and information technology;

- analysis and generalization of research results using modern achievements of science and technology, advanced domestic and foreign experience in the field of geophysics and geology; - evaluation of the results of scientific and geophysical research, preparation of scientific reports, publications, reports, preparation of applications for inventions and discoveries.

c) scientific and production activities:

- independent preparation and carrying out of production and scientific-production, field, laboratory and interpretive work in solving practical geological and geophysical problems;

- independent selection, training and professional operation of digital geophysical field and laboratory equipment and instruments;

- collection, analysis and systematization of a priori geological and geophysical information using modern information technologies;

- complex digital processing, interpretation and modeling of field and laboratory information in order to solve scientific and production geological and geophysical problems;

- determination of the economic efficiency of scientific and industrial geological and geophysical research;

- participation in the development of normative methodological documents in the field of geological and geophysical work.

d) project activities:

- design and implementation of scientific and technical projects in geology and geophysics;

- design of works in the field of rational subsurface use and protection of the geological environment;

- participation in the examination of projects of scientific research geological and geophysical works;

2. The purpose and objectives of the educational program

The Department of Geophysics and Seismology conducts educational activities in the field of training on the trajectory of the 7M07147 Master's degree in Digital (Exploration) Geophysics.

The Department plans to train professional geophysicists in the following theoretical and applied areas:

- prospecting and exploration of mineral deposits;
- application of innovative methods of geophysics methods based on the use of digital measuring and processing complexes;
- the use of modern digital technologies and software for processing and analyzing geophysical data based on the acquired in-depth knowledge;
- implementation of research projects in the field of digital signal processing, machine learning algorithms and modeling of geophysical processes;
- carrying out an integrated approach to the interpretation of geophysical data with digital information from related fields;
- design, organization and management of production geophysical work in the search and exploration of mineral deposits.
- implementation of project management and scientific communication skills in the implementation of research projects.

The goals and objectives of the presented educational program are formulated taking into account the requirements and requests of potential consumers, as well as based on the assessment of the relevance of this educational program, which is determined by the interests of potential employers, students, the potential of the university, the requirements of the state and society as a whole.

The purpose of the educational program: Training of highly qualified specialists capable of effectively using modern digital technologies to solve production problems using the skills of planning, organizing and managing work based on the principles of inclusive education and sustainable development in the field of digital (exploration) geophysics

OP tasks:

- obtaining the foundation of professional education based on general technical and managerial knowledge of a cycle of basic disciplines;
- the study of a cycle of specialized disciplines focused on key theoretical and practical aspects of digital technology and technology for conducting geophysical research;
- familiarization with the methods, technologies and equipment of government, operator and service services and companies during the research internship;
- training undergraduates in methods of collecting a priori information for the design, organization and management of field and in-house geophysical work in solving assigned tasks;
- training in methods of organization and management of field geophysical research;
- training in conducting auxiliary operations for checking, calibrating and configuring geophysical equipment, taking into account the specifics of digital registration of geophysical fields, as well as conducting field and desk data

processing;

- acquisition of general technical and administrative management skills and ensuring timely implementation of the interpretation of geophysical materials based on the use of digital interpretation systems;

- acquisition of skills in compliance with the requirements of occupational safety, safety and environmental protection, as well as fire safety during geophysical research.

3. Requirements for the assessment of learning outcomes of the educational program

Graduates of the specialized Master's degree program are awarded the academic degree of Master of Engineering and Technology.

A graduate of the Department of Geophysics and Seismology in the Master's degree program should know:

- goals and objectives of digital geophysics in the geosciences system;
- be aware of the social significance of your future profession;
- possess high motivation to perform professional activities;
- be able to evaluate the possibilities of geophysics methods and navigate the conditions of applicability of geophysical surveys;
- possess skills in working with geophysical equipment and geophysical data, as well as computer skills as a means of managing digital information.
- as part of a research team, demonstrate the ability to lead, design and conduct geophysical research, participate in the preparation of projects, reports, abstracts, bibliographies on the subject of scientific research, and in the preparation of publications;
- demonstrate skills in working with field and laboratory geophysical instruments, installations and equipment.
- to apply in practice methods of collection, processing, analysis and generalization of stock, field and laboratory geological and geophysical information; to participate in the organization of scientific and practical seminars and conferences.

The volume of the bachelor's degree program is 90 credits, regardless of the form of study and the educational technologies used.

The content of the OP "Digital (exploration Geophysics)" is formed on the basis of the development of a multi-level system of personnel training, fundamental principles and quality of education, continuity and continuity of education and science, unity of education, education, research and innovation activities aimed at maximizing consumer satisfaction and should ensure:

- obtaining a full-fledged and high-quality theoretical and professional education in the field of geophysics, confirmed by the level of knowledge and skills, skills and competencies, based on criteria established by the State Educational Standard, their assessment, both in content and volume;
- preparation of masters for the geophysical industry who know the technology and methods of conducting geophysical research, digital methods of processing, interpreting and modeling the data obtained, ready to be managers and managers on production projects;

- application of knowledge of fundamental and technical sciences, including geology, tectonics, and the theoretical and applied foundations of geophysical methods;
- the use of system analysis methods when evaluating the obtained geophysical data;
- knowledge of modern problems of geophysics;
- acquisition of practical skills in working with digital geophysical equipment, modern software in processing, interpreting and modeling the obtained geophysics data using modern information and digital technologies;
- the use of methods, skills and modern technical means necessary in the study of physical processes in the bowels of the Earth, the identification and prospecting of oil and gas promising facilities and deposits of solid minerals;
- the ability to work with the necessary, updated literature, computer information, databases and other sources of information to solve tasks.;
- formation of students' skills to work in a team, but at the same time to show individuality, and, if necessary, to solve problems independently;
- formation of undergraduates' industrial and ethical responsibility, the ability to understand the problem from working with various specialists, to find optimal solutions, and the need to improve their knowledge and skills;
- the readiness of undergraduates for professional activity through disciplines that provide in-depth professional knowledge, skills and skills of working in production, government organizations and services, research institutes and educational institutions;
- possess erudition, knowledge of modern social and political issues, speak the state, Russian and foreign languages, tools of the market economy, safety and environmental issues.

4. Passport of the educational program

4.1. General information

Table 1- Educational program passport

№	Field name	Note
1	Code and classification of the field of education	7M07 "Engineering, manufacturing and construction industries"
2	The code and classification of training areas	7M071 "Engineering and Engineering"
3	Group of educational programs	M109 "Petroleum and ore Geophysics"
4	Name of the educational program	7M07147 – "Digital (exploration) Geophysics"
5	Brief description of the educational program	The Master's degree program (1.5 years) for training in the field of 7M – "Digital (exploration) Geophysics" provides: a) in-depth training of specialists in the field of physico-geological foundations of geophysical methods, digital data recording technologies and their application in the search and exploration of minerals; b) obtaining high-quality knowledge by undergraduates in digital processing, modeling of geophysical processes and geological interpretation of geophysical data using modern digital software; c) undergraduates gain knowledge and modern ideas about statistical methods and machine learning for analyzing and processing large amounts of geophysical data; d) students acquire a set of knowledge on the use of geographic information systems (GIS) for visualization, integration of geophysical data with other geoscientific data and analysis of the results.
6	The purpose of the educational program	Training of highly qualified specialists capable of effectively using modern digital technologies to solve production problems using the skills of planning, organizing and managing work based on the principles of inclusive education and sustainable development in the field of digital (exploration) geophysics
7	Type of educational program	New EP
8	The NRK level	7
9	ORC Level	7
10	Distinctive features of the OP	no
11	The list of competencies of the educational program:	**General cultural competencies (GC):** GC -1 Ability to communicate orally and in writing in the state, Russian and foreign languages to solve problems of interpersonal and intercultural interaction; GC -2 The ability to critically use the methods of modern science in practice OK-3 Awareness of the need and acquisition of the ability to independently study and improve their skills throughout their work GC -4 The meaning and understanding of professional ethical standards, mastery of professional communication techniques GC -5 Ability to work in a team, tolerant of social, ethnic, religious and cultural differences GC -6 Ability to use the basics of economic knowledge in various fields of activity. **General Professional competencies (GPC):** GPC-1 is the ability to independently acquire new knowledge using modern educational and information technologies

		OPK-2 Possession of computer skills sufficient for professional activity and knowledge of professional programs OPK-3 Knowledge of basic methods, methods and means of obtaining, storing, processing information, the ability to use modern digital technical means and information technologies to solve professional problems GPC-4 Understanding of the essence and knowledge of information in the development of modern society, the ability to receive and process information from various sources, the willingness to interpret, structure and formalize information in a form accessible to others **Professional Competencies (PC):** PC 1 is the ability to systematically study scientific and technical information, domestic and foreign experience in the geophysical profile of training PC 2 is the ability to integrate applied sections of geophysics and specialized geological and geophysical knowledge (including physical processes occurring in the Earth) to solve industrial problems of geology and geophysics; PC 3 is the ability to participate in work on innovative projects using in-depth research methods. Mastery of systematic logical thinking skills in analyzing scientific data and setting practical tasks for geophysical research; PC 4 is the ability to generalize geological and geophysical information to select the main parameters of a field geophysical survey, to guide, design and conduct experimental and methodological work and optimize the methods of geophysical observations; PC 5 is the ability to independently set specific tasks of geophysics and solve them based on the use of modern digital equipment, innovative software and information technologies using the latest domestic and foreign experience; PC 6 is the ability to manage scientific and production work in solving complex problems of geophysics, at the stages of design, execution (including processing, analysis and interpretation) and preparation of reports to present the results; PC 7 Proficiency in professional operation of modern geophysical field equipment; determination of technical and technological parameters of equipment, equipment, materials and preparation of equipment for field work (adjustment, verification or testing, preventive maintenance); PC 8 Skills in organizing and conducting geophysical observations and primary processing of recorded data; PC 9 The ability to carry out metrological measures for the preparation of equipment, facilities and installations with an acceptable error. Calibration and standardization of geophysical equipment designed to solve geophysical problems. Skills in organizing and conducting high-quality digital processing for linking and joint geological interpretation of the results of previous stages of processing geophysical and petrophysical data. Organization of registration of processing results and their transfer to the customer; PC 10 Possession of digital computer software packages designed to work with a complex of geophysical data; PC 11 is the ability to analyze and apply laws on subsoil and

		subsurface use, industrial safety and environmental code, state geophysical expertise, and regularly monitor changes and additions to these legal norms and laws.; PC 12 is the ability to identify and systematize the main ideas in scientific publications; critically evaluate the effectiveness of various approaches to solving problems in geophysics; formulate an independent view of the proposed problem, taking into account the latest domestic and foreign experience and knowledge of the main directions of development and problems of geophysics, the current level of elaboration of problems and the most promising areas of development.
12	Learning outcomes of the educational program	LO 1. Demonstrate the ability to communicate in business interpersonal languages in Kazakh, Russian and English when solving problems related to solving geological and geophysical problems based on the principles of partnership in the interests of sustainable development LO 2. Use management principles, various approaches to management, including motivation, leadership, teamwork skills and psychological influence on employees based on gender equality and inclusion principles to improve management efficiency and organizational climate in solving production problems LO 3. Demonstrate theoretical and practical knowledge in the field of physical, mathematical and natural sciences, information technology, artificial intelligence and machine learning when conducting field observations, processing, interpretation and modeling of geophysical data based on the obtained analytical, technical and managerial competencies, taking into account the characteristics of employees while respecting their individuality LO 4. Demonstrate high-quality knowledge and skills in the professional operation of digital geophysical equipment and preparation of equipment for work, management of field geophysical measurements, implementation of the most optimal conditions for responsible consumption and production of work LO 5. Apply methods of collecting, digitally processing and interpreting geophysical data, visualize the results of the analysis and present them in an accessible form to solve problems of prospecting and exploration of mineral deposits for the purpose of industrialization and implementation of innovations LO 6. Demonstrate technical and administrative leadership skills to respectfully motivate employees to make their own decisions on integrated geological and geophysical modeling and interpretation tasks based on the use of innovative digital technologies and machine learning to study the geological structure, assess prospects and calculate mineral reserves, taking into account the principles of sustainable development goals LO 7. Organize research activities in the field of geophysics, including setting tasks, developing research methods and analyzing the results obtained, designing, developing and maintaining databases, ensuring efficient storage, processing and access to geophysical information
13	The form of education	full-time
14	Duration of training	1,5

15	Volume of loans	90
16	Languages of instruction	Russian/Kazakh
17	Academic degree awarded	Master of Engineering and Technology
18	Developer(s) and authors:	1. Professor Abetov A.E., 2. Associate Professor Umirova G.K., 3. lecturer Muzapparova A. B.

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

Table 2 – Results of training in the educational program "Digital (exploration) Geophysics"

№	Name of the discipline	Brief description of the discipline	Number of credits	Generated learning outcomes (codes)						
				LO 1	LO 2	LO 3	LO 4	LO 5	LO 6	LO 7
CYCLE OF BASIC DISCIPLINES (BD)										
M-1. Module of basic training (university component)										
1	English (professional)	The purpose of the discipline is to acquire and improve competencies in accordance with the trade standards of foreign education that can compete in the labor market, because through a foreign language, the future master's student gets access to academic knowledge, new technologies and modern information that allows using a foreign language as a means of communication in the intercultural, professional and scientific activities of the future master.	**2**	**2**	**V**					
2	Management	**Objective:** to form a scientific understanding of management as a type of professional activity. **Content:** mastering by undergraduates of general theoretical provisions of management of socio-economic systems; mastering skills and practical solutions to management problems; studying the world experience of management, as well as the peculiarities of Kazakhstani management; training in solving practical issues related to the management of various aspects of organizations.	**2**	**2**		**V**				
3	Management Psychology	**Objective:** To acquire skills in making strategic and managerial decisions, taking into account the psychological characteristics of the individual and the team. **Contents:** the modern role and content of psychological aspects in management activities, methods of improving psychological literacy, the composition and structure of management activities, both at the local and foreign levels, the psychological peculiarity of modern managers.	**2**	**2**		**V**				

Component of choice										
4	Prediction, prospecting and exploration of mineral deposits based on geophysical data	**Objective:** to teach the interpretation of geophysical data using digital methods and technologies for forecasting, prospecting and exploration of mineral resources and minerals (MPI) **Contents:** An introduction to geophysics and its role in exploration of the MPI. Methods of potential fields. Seismic methods. Geophysical research of wells. Methods of processing geophysical data. Interpretation of research results. Modeling of geological structures. Forecasting the distribution of minerals. Analysis of real-world examples of MPI exploration. Digital forecasting technologies in geophysics	**4**				**V**	**V**	**V**	**V**
5	Petrophysical fundamentals of comprehensive interpretation of geophysical data	**Objective:** To study the petrophysical properties of rocks and their influence on the results of interpretation of geophysical data for a comprehensive analysis of data from geophysical methods in order to reliably construct models of deposits. **Contents:** Basic concepts and tasks of petrophysics. Density, porosity, permeability. Laboratory and field methods for studying petrophysical properties. Integration of seismic, electrical and magnetic data for a comprehensive interpretation of geophysical data. Application of petrophysical models in geological exploration. Analysis of real examples of petrophysical modeling.	**4**			**V**		**V**	**V**	**V**
6	Mathematical modeling in geophysics	**Objective:** to study mathematical modeling (MM) methods for solving geophysics problems for a deep understanding of the physical processes occurring in the Earth's crust. **Contents:** Introduction to MM. Analytical and numerical methods MM. Modeling of physical processes: wave processes, thermal conductivity, electromagnetic fields. Using MM to interpret geophysical data. Digital software tools MM. The use of 3D and 4D visualization in the interpretation of geophysical data. Innovative high-tech technologies for	**5**			**V**			**V**	

		geophysical research.								
7	Hi-Tech technologies in geophysics	**Objective:** to study modern high technologies and the latest achievements in the field of technologies for collecting, processing and analyzing geophysical data, as well as their impact. **Contents:** Introduction to Hi-Tech technologies and their role in geophysics. Modern methods of collecting geophysical data: remote sensing of the Earth, unmanned aerial vehicles (drones). Hi-Tech GIS technologies. Data processing technologies: machine learning and artificial intelligence in geophysics. Review of the results of the application of Hi-Tech technologies in the fields of the Republic of Kazakhstan.	**5**			**V**	**V**	**V**	**V**	
CYCLE OF PROFILE DISCIPLINES (PD)										
M-2. Module of professional activity (university component, component of choice)										
8	Digital measurement and processing systems for potential field studies	**Objective:** To study the principles of operation and application of digital measuring and processing systems for exploring potential fields, as well as mastering data processing and analysis methods. **Contents:** The principle of operation of electro-, gravity-magnetic exploration equipment. Preparation of measuring systems for operation. Methods of studying potential fields (gravity exploration, magnetic exploration, electrical exploration). Data processing software. The results of the processing stage and the preparation of materials for data analysis and interpretation.	**5**			**V**	**V**			
9	Modern information measurement systems in seismic	**Objective:** to study modern information and digital seismic exploration systems and their role in improving the effectiveness of research. **Contents:** Fundamentals of seismic exploration and its significance. An overview of modern methods and technologies in seismic exploration. Architecture of information and digital systems. Linear recording systems, time-frequency characteristics. Fundamentals of digital registration of seismic signals, their analog	**5**			**V**	**V**	**V**	**V**	

		and digital registration. Telemetric seismic recording systems. Methods of collecting and processing seismic data. Integration of information systems in the process of seismic exploration.								
10	Interpretation software systems in ore geophysics	**Objective:** to study the interpretation of geophysical data in the search and exploration of ore deposits, the development of digital interpretation systems for solving problems of ore geophysics. **Contents:** Regional, exploratory, detailed geophysical studies in ore regions. Reference seismic profiles of GSZ, GSP, KMPV, MOV. Gravimetric surveys. Aeromagnetic surveys. Electrical exploration work. Programs for classifying petrophysics of ore intervals according to logging diagrams. Oasis Montaj software package (Geosoft). Determination of ore intervals when calculating reserves in the Micromine program.	**5**				**V**	**V**	**V**	**V**
11	Geophysical methods in the exploration and prospecting of radioactive ores	**Objective:** in-depth study of geophysical methods for the study of radioactive ores and the development of digital complexes for processing and interpreting geophysics data **Contents:** Natural and artificial radioactivity. Radioactive decay, composition and interaction of radioactive radiation with the environment. Radioactivity of rocks and ores. Nuclear and physical properties of rocks. Hardware features and methods of studying radioactive ores. Digital software and interpretation systems for processing and interpreting radiometric data. Integration of methods in the search for radioactive ores.	**5**			**V**	**V**	**V**	**V**	
12	Specialized software for petrolrum geophysics	**Objective:** To study specialized software in the search, exploration and development of hydrocarbon deposits **Contents:** Overview of the state of domestic and foreign software in the oil and gas industry. Specialized software from US companies. Specialized software for the oil and gas industry in Russia, Common field models for storing, accumulating, and transmitting information. Tasks of specialized software. The use of artificial	**5**			**V**	**V**	**V**	**V**	

		intelligence (AI) and machine learning algorithms in solving problems in geophysics. Software for interpreting seismic data								
13	Multicomponent seismic	**Objective:** In-depth study of the hardware features and methods of recording, processing and interpreting multi-wave seismic data. **Contents:** Principles of elastic wave propagation, exchange of P- and S-waves at layer boundaries. Methods of excitation of elastic waves, power, frequency, directivity, repeatability of a seismic source. Digital seismic data recording systems, electrodynamic and multicomponent receivers. Features of data processing on transverse and exchange waves. Interpretation of multi-wave seismic data. The difference from classical P-wave approaches.	**5**					**V**	**V**	**V**
14	Seismic facies analysis and predictive models for oil and gas fields	**Objective:** In-depth study of seismic facies analysis (SA) and its application in modeling and identifying productive zones of oil and gas **Contents:** Principles and stages, effectiveness and range of tasks of seismic facies analysis. The use of CA in geological modeling. Digital technologies and CA techniques. Identification and contouring of objects based on seismic paleoisochrons for conducting SA. Detailed interpretation of a geological object. Seismic images of geological processes and phenomena using SA.	**5**				**V**	**V**	**V**	**V**
15	Seismic modeling and inversion	**Objective:** To study the effectiveness of research methods for complex terrigenous and carbonate reservoirs based on inversion and modeling **Contents:** Mathematical methods used in seismic inversion. Methods of seismic inversion. Methods for predicting oil and gas traps in homogeneous and heterogeneous terrigenous reservoirs. Using seismic inversion to isolate the reservoir. Seismic inversion and modeling of different types of media. Assessment of the pore space of carbonate reservoirs. Studying the results of modeling and inversion on seismic data	**5**					**V**	**V**	**V**

16	Digital models of geological environments based on gravity and magnetic exploration data	**Objective:** To systematize knowledge about digital technologies and methods of studying gravimagnetic fields, while solving the direct and inverse problems for the geological interpretation of data. **Contents:** Features of the geological interpretation of gravimagnetic data, a priori geological-geophysical, petrophysical information. Stages of interpretation of gravitational and magnetic field anomalies. Construction of a physico-geological model. Identification of geological and geophysical criteria for the MPI search based on gravimagnetic exploration data. Principles of integrating gravimagnetic exploration. Creation of geologically significant models, assessment of their reliability	**5**				**V**	**V**	**V**	**V**
17	Geophysical data geoinformation systems	**Objective:** to study geographic information systems (GIS) with the acquisition of skills for automated interpretation and preparation of a digital database of geophysical data (DB) **Contents:** Databases of geological and geophysical data. Classification, structure and types of databases, basic tools. Coordinate systems, the transition between them. Vectorization of raster images (geophysical maps). Formation of a geological and geophysical database. Features of application of geoinformation systems in geophysics. Creating three-dimensional models, displaying surfaces in various forms, and analyzing surfaces. Three-dimensional visualization.	**5**			**V**	**V**	**V**	**V**	
18	Digital models of geological environments based on electrical prospecting data	**Objective:** To study modern digital technologies and gain skills in building 1, 2, 3D models based on electrical intelligence data. **Contents:** Classification of electrical exploration methods, tasks, hardware features and digital technologies. The concept of a physico-geological model. Electrical properties of rocks. Links between electrical exploration anomalies and geological objects. Two-dimensional modeling (2D) of natural field method (EP) data. Calculation of the direct problem for	**5**				**V**	**V**	**V**	**V**

		the VEZ-VP 1D curves (GeoModel). Calculation of 2D inversion of electrotomography. The one-dimensional interpretation program IPI2win.								
19	Digital methods of remote sensing data processing	**Objective:** to study the main stages and methods of remote sensing processing with the acquisition of practical skills in using digital programs: ENVI, ERDAS, Scanex Image Processor, Photomod RADAR. **Contents:** Stages, processed levels, used remote sensing data formats. The concept of geometric distortion of images, causes, and removal methods. Orthotransformation. Methods for improving the quality of satellite images. Classification of transformations for quality improvement. Application of software complexes for processing Earth remote sensing data.	**5**			**V**	**V**	**V**	**V**	**V**
20	Methods for digital model building of pay horizons based on well logging data	**Objective:** to study the methodology of constructing three-dimensional digital models based on geological, geophysical and field data **Contents:** Technology for creating 3D digital models based on GIS data. Creation of a priori digital base of productive horizons and its role. Justification of the VNC based on GIS materials in the construction of the ZD model. The methodology for calculating the initial oil saturation coefficient for wells and their selection. Construction of 3-dimensional grids of filtration-capacitance properties and saturation. Modeling of hydrocarbon deposits and calculation of reserves in various programs	**5**				**V**	**V**	**V**	**V**
21	Geological modeling of ore objects based on well logging data	**Objective:** To study the methodology for creating a model of ore bodies based on geographic information systems (GIS) data for predicting ore deposits **Contents:** GIS technologies for forecasting ore deposits. Classification and types. Spatial forecasting tasks. The role of an integrated approach to constructing the spatial distribution of the properties of the geological environment. Forecast map and predictive function. The method of analogies and computer	**5**			**V**	**V**	**V**	**V**	**V**

		forecast. Network technology of geoinformation research of spatial data. Regional forecast of hydrothermal lead-zinc deposits on the example of Bulgaria.								
22	Computer technologies for creating geophysical databases	**Objective:** to study the principles of design, development and management of geophysical databases (GBD) using digital computer technologies **Contents:** Definition and classification of geophysical data. Conceptual, logical, and physical models. Data normalization and database schema design. Relational and non-relational databases. The choice of technology for storing GBD. Methods for processing large amounts of data. Tools for analyzing and visualizing geophysical data. An overview of popular DBMS and tools for working with GBD.	**5**			**V**			**V**	
23	Technologies and methods of geophysical data visualization	**Objective:** to study methods and programs of visualization of geophysical data for effective representation of volumetric geophysical data **Contents:** Geophysical methods, data and forms of their representation. One-dimensional, two-dimensional, and three-dimensional visualization. Using color maps and contour graphs. Visualization of time series and spatial data. An overview of popular visualization programs (MATLAB, Python, specialized geophysical packages). Virtual and augmented reality. Using machine learning to improve visualization.	**5**				**V**	**V**	**V**	**V**
24	Artificial intelligence and machine learning in geophysics	**Objective:** To study artificial intelligence (AI) and machine learning (MO) methods for analyzing geophysical data, modeling processes and forecasting deposits. **Contents:** An introduction to AI and MO. Basic concepts, definitions, and development history. An overview of MO algorithms (regression, classification, clustering). Deep learning and neural networks. The use of AI and MO in the analysis of geophysical data. Modeling of geophysical processes. Forecasting and interpretation. Examples of successful application of AI	**4**				**V**	**V**	**V**	

		and MO in geophysical research								
25	Analysis and interpretation of seismic tomography data	**Objective:** To study methods of interpreting seismic tomography (CT) data with the acquisition of skills in identifying geological objects based on modern algorithms and software **Contents:** The basic principles of art. Engineering and technology, digital field data recording complexes ST. Pre-processing of seismic signals. Inverse problems and methods of their solution. Algorithms for constructing velocity models. Data visualization and interpretation of geological structures. Application of seismic tomography	**4**				**V**	**V**	**V**	

5. The curriculum of the educational program

NON-PROFIT JOINT STOCK COMPANY
"KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY NAMED AFTER K.I. SATBAYEV"

SATBAYEV UNIVERSITY

«APPROVED»
Decision of the Academic Council
NPJSC«KazNRTU
named after K.Satbayev»
dated 20.02.2025 Minutes № 9

WORKING CURRICULUM

Academic year	**2025-2026 (Autumn, Spring)**
Group of educational programs	**M109 - "Oil and ore geophysics"**
Educational program	**7M07147 - "Digital (exploration) Geophysics"**
The awarded academic degree	**Master of engineering and technology**
Form and duration of study	**full time (professional track) - 1,5 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	
									1 sem	2 sem	3 sem	
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)												
CYCLE OF BASIC DISCIPLINES (BD)												
M-1. Module of basic training (university component)												
LNG212	Foreign language (professional)		BD, UC	2	60	0/0/30	30	E	2			
MNG726	Management		BD, UC	2	60	15/0/15	30	E	2			
HUM211	Psychology of management		BD, UC	2	60	15/0/15	30	E	2			
M-1.1 Component of choice												
GPH766	Prediction, Prospecting, and Exploration of Mineral Deposits Using Geological and Geophysical Data	1	BD, CCH	4	120	30/0/15	75	E	4			
GPH767	Petrophysical Fundamentals of Comprehensive Interpretation of Geophysical Data	1	BD, CCH	4	120	30/0/15	75	E	4			
GPH768	Mathematical Modeling in Geophysics	2	BD, CCH	5	150	30/0/15	105	E	5			
GPH769	Hi-Tech technologies in geophysics	2	BD, CCH	5	150	30/0/15	105	E	5			
CYCLE OF PROFILE DISCIPLINES (PD)												
M-2. Module of professional activity (component of choice)												
GPH770	Digital Measurement and Processing Systems for Potential Field Exploration	1	PD, CCH	5	150	30/0/15	105	E	5			
GPH771	Modern Information Measurement Systems in Seismic Exploration	1	PD, CCH	5	150	30/0/15	105	E	5			
GPH772	Interpretation Complexes in Ore Geophysics	2	PD, CCH	5	150	30/0/15	105	E	5			
GPH773	Geophysical Methods for the Exploration and Prospecting of Radioactive Ores	2	PD, CCH	5	150	30/0/15	105	E	5			
GPH774	Specialized Software for Oil and Gas Geophysics	3	PD, CCH	5	150	30/0/15	105	E	5			
GPH775	Multicomponent seismic	3	PD, CCH	5	150	30/0/15	105	E	5			
GPH776	Seismic Facies Analysis and Forecasting Models for Oil and Gas Reservoirs	1	PD, CCH	5	150	30/0/15	105	E		5		
GPH777	Seismic modeling and inversion	1	PD, CCH	5	150	30/0/15	105	E		5		
GPH778	Digital Models of Geological Environments Based on Gravimagnetic Exploration Data	2	PD, CCH	5	150	30/0/15	105	E		5		
GPH779	Geoinformation Systems for Geophysical Data	2	PD, CCH	5	150	30/0/15	105	E		5		
GPH780	Digital Models of Geological Environments Based on Electrical Prospecting Data	3	PD, CCH	5	150	30/0/15	105	E		5		
GPH781	Digital Methods for Remote Sensing Data Processing	3	PD, CCH	5	150	30/0/15	105	E		5		
GPH782	Methods for Building Digital Models of Productive Horizons Based on well logging Data	4	PD, CCH	5	150	30/0/15	105	E		5		
GPH783	Geological Modeling of Ore Bodies Based on Geographic Information Systems (GIS) Data	4	PD, CCH	5	150	30/0/15	105	E		5		
GPH786	Artificial Intelligence and Machine Learning in Geophysics	5	PD, CCH	5	150	30/0/15	105	E		5		

GPH787	Analysis and Interpretation of Seismic Tomography Data	5	PD, CCH	5	150	30/0/15	105	E		5		
GPH784	Computer Technologies for Creating Geophysical Databases	1	PD, CCH	4	120	30/0/15	75	E			4	
GPH785	Technologies and Methods for Geophysical Data Visualization	1	PD, CCH	4	120	30/0/15	75	E			4	
M-3. Practice-oriented module												
AAP248	Internship		PD, UC	5				R		5		
M-4. Experimental and research module												
AAP249	Experimental research work of a master student, including an internship and the implementation of a master's project		ERWMS	18				R			18	
M-5. Module of final attestation												
ECA213	Design and defense of the master's project		FA	8							8	
Total based on UNIVERSITY:									30	30	30	
									60		**30**	

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	0	0	0	0
BD	Cycle of basic disciplines	0	6	9	15
PD	Cycle of profile disciplines	0	5	44	49
Total for theoretical training:		**0**	**11**	**53**	**64**
RWMS	Research Work of Master's Student				0
ERWMS	Experimental Research Work of Master's Student				18
FA	Final attestation				8
TOTAL:					**90**

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Minutes № 4 dated 03.02.2025

Decision of the Academic Council of the Institute. Minutes № 5 dated 28.01.2025

Signed:

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

Approved:

Vice Provost on academic development — Kalpeyeva Z. B.

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

Director - Geology and Oil-gas Business Institute named after K. Turyssov — Auyelkhan Y. .

Department Chair - Geophysics and seismology — Ratov B. T.

Representative of the Academic Committee from Employers ___Acknowledged___ — Khitrov D. M.