Geology and Oil -gas Business Institute named after K.Turyssov
Department of "Geophysics and Seismology "

EDUCATIONAL PROGRAM
6B07201 «Oil and gas and ore geophysics»

Code and classification of the field of education: **6B07 «Engineering, Manufacturing and Civil engineering»**
Code and classification of training areas: **6B072 «Manufacturing and processing»**
Group of educational programs: **B071 «Mining and mineral extraction»**
Level based on NQF: 6
Level based on IQF: 6
Study period: 4 years
Amount of credits: 240

Almaty 2024

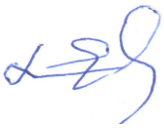
The educational program 6B07201 «Oil and gas and ore geophysics» was approved at the meeting of NJSC "Kazakh National Research Technical University named after K.I.Satpayev" Academic Council

Protocol № 12 of April 22, 2024.

Was Reviewed and recommended for approval at the meeting of NJSC "Kazakh National Research Technical University named after K.I.Satpayev" Educational and Methodological Council

Protocol № 6 of April 19, 2024.

The educational program 6B07201 «Oil and gas and ore geophysics» was developed by the academic committee in the field of training: 6B072 "Manufacturing and processing".

Full name	Academic degree/ academic title	Post	Place of work	Signature
Chairperson of the Academic Committee:				
Khitrov Dmitry Mikhailovich	Candidate of Technical Sciences	Manager of the company's data processing center	«PGS Kazakhstan LLP»	
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 Egemberdyevich	Doctor of Geological and Mineralogical Sciences, Professor	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"	

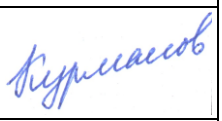
Aliakbar Madiyar Manarbekuly	Master of Technical Sciences	Senior Teacher	NJSC "Kazakh National Research Technical University named after K.I.Satpayev"	
Employers:				
Kurmanov Baurzhan Koptleuovich	Master of Technical Sciences	General manager	OPTIMUM Design Institute LLP	
Students				
Daurbaeva Gulbanu 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"	
Kirsanova Ekaterina	-	1st year Master's student	NJSC "Kazakh National Research Technical University named after K.I.Satpayev"	

Table of contents

	List of abbreviations and designations	5
1.	Description of the educational program	6
2.	The purpose and objectives of the educational program	9
3.	Requirements for evaluating the educational program learning outcomes	11
4.	Passport of the educational program	12
4.1.	General information	12
4.2.	The relationship between the achievability of the formed learning outcomes according to the educational program and academic disciplines	17
5.	Curriculum of the educational program	35

List of abbreviations and designations

EP – educational program;
NJSC «KazNITU named after K.I.Satpayev» – Non-profit Joint Stock Company «Kazakh National Research Technical University named after K.I. Satpayev»;
SDG-Sustainable Development Goal;
NQF – National Qualifications Framework;
U – universal, social and ethical competencies;
OQF – Industry Qualifications Framework;
PC – professional competencies;
LO – learning outcomes of the educational program;
S – special and managerial competencies;
JSC – joint stock company;
LLP - limited liability partnership;
BD- basic discipline;
PD- profile discipline;
UC- University component;
CC-Component of choice;
FA- final assessment.

1. Description of the educational program

The bachelor's degree program 6B07201 "Oil and gas and ore geophysics" was developed within the framework of the direction 6B072 "Manufacturing and processing Industries" field and is closely aligned with the Sustainable Development Goals (SDGs). The program provides high-quality education and skills that contribute not only to economic growth but also to the sustainable use of natural resources, allowing students to integrate sustainable practices and approaches into their research and practical activities.

Alignment of the Program with the Sustainable Development Goals:

1. *Goal 4: Quality Education*

The program is aimed at providing access to quality and inclusive education, which develops students' competencies and knowledge in the field of geophysics, preparing them to address current challenges in scientific research and technology. Quality education enables students to successfully work in industries related to the exploration and development of mineral deposits, which is vital for the country's sustainable development.

2. *Goal 7: Affordable and Clean Energy*

Geophysics plays a key role in the exploration of energy resources such as oil, gas, and other natural resources. The bachelor's program helps prepare specialists who will work effectively in the exploration and exploitation of these resources, contributing to more rational energy use while considering environmental aspects.

3. *Goal 9: Industry, Innovation, and Infrastructure*

The program includes the training of specialists who will work on the development of new technologies and methods in the field of geophysics, as well as ensure the operation of modern equipment for geophysical research. This contributes to the development of innovative technologies and sustainable infrastructure for the effective exploration and utilization of natural resources.

4. *Goal 12: Responsible Consumption and Production*

It is important to note that programs like 6B07201 "Oil and Gas and Mining Geophysics" teach students approaches to exploration and development that are focused on the sustainable use of natural resources. Effective geophysical research methods allow for more accurate identification of resources and minimize environmental impact.

5. *Goal 13: Climate Action*

Educating specialists who will use geophysical methods to identify mineral deposits promotes a more sustainable and rational approach to resource exploration and exploitation. This helps reduce ecological risks and impacts on the climate, as well as work towards finding alternative and more environmentally friendly energy sources.

6. *Goal 15: Life on Land*

Geophysics plays an important role in minimizing the impact on ecosystems through accurate data and methodologies that help avoid unnecessary environmental destruction during the exploration and development of deposits.

Thus, the educational program 6B07201 "Oil and Gas and Mining Geophysics" contributes to the preparation of specialists who will actively participate in solving global sustainable development challenges, including economic growth, natural resource use, and environmental protection.

Program objectives:

1. Training of specialists: The program provides knowledge and skills that will allow graduates to work effectively in geophysical research for prospecting and exploration of mineral deposits.

2. Rational use of methods and technologies: Students learn to apply complex methods of geophysical research, which allows optimizing the processes of deposit search and reducing the impact on the environment.

3. Analysis and interpretation of data: It is important that the program teaches students how to effectively analyze geophysical data, which is an integral part of making decisions on deposit exploration taking into account environmental sustainability.

Thus, the bachelor's program 6B07201 "Oil, Gas and Ore Geophysics" responds to the challenges posed by the Sustainable Development Goals and is aimed at training specialists who will be able to work effectively and responsibly in the field of geophysics, taking into account sustainability, innovation and environmental principles.

The program includes training to work in modern computer programs Studio RM, Petrel, Eclipse, Surfer, Oasis montaj (Geosoft), Geolog-Focus, Echos-Gold.

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 geophysics and geology of solid minerals, oil and gas.

Students undergo an educational geophysical practice at their own training ground in Karatau.

Industrial practice is carried out in the following operator and service companies:

"Kazgeoinform" LLP, Karachaganak Petroleum Operating B.V., JSC "AK Altynalmas", JSC "Volkovgeologiya", "Kazakhmys Corporation" LLP, "Sezmizbay-U" LLP, "Kazzinc" LLP, "Kaspiymunaigas", "Zhaikmunai" LLP, "Tau-ken Altyn" LLP, "Resources Capital Group", "Geo-munai XXI" LLP, "VOSTOK Mining Company" LLP, JSC "Altyntau Kokshetau", National Nuclear Center of the Republic of Kazakhstan of the Ministry of Energy of the Republic of Kazakhstan, "KMG Engineering" LLP, "Petrel Al" LLP and others

The best students can get additional education under the academic mobility program at the Colorado School of Mines (USA), Tomsk Polytechnic University, Frye University, Lorraine University (Nancy, France), the Institute of Mining Engineering and Technology (Beijing, China) and other universities around the world.

Graduates receive a Bachelor of Engineering and Technology qualification and can work in research institutes, oil and gas and mining companies in engineering and technical positions.

The positive aspects of the profession within the framework of the geophysical specialty include the following interesting analytical work, a high salary level, the possibility of career growth, demand in the labor market, the possibility of employment in foreign companies.

Field of professional activity:

The field of professional activity of the bachelor includes a set of technologies, tools, methods and methods aimed at the search, exploration and exploitation of mineral deposits, the study of processes in the bowels of the Earth.

Objects of professional activity:

Geological bodies in the Earth's lithosphere, mine workings, physical fields in rocks, as a source of measuring information for geological exploration, mathematical and physical models of formations, sections, mineral deposits in the process of their exploration and development; geophysical computerized and software-controlled information-measuring and processing systems and complexes; theoretical and physical models for their design and operation.

The subjects of professional activity are:

Study of the structure of the Earth's crust, its physical models 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 reduction of technogenic load on the environment.

The areas of professional activity of the bachelor are:

- organizations of 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 conducting geological exploration for prospecting, exploration and additional exploration of mineral deposits, as well as implementing control over the development of deposits;
- organizations related to environmental monitoring and solving environmental problems;
- institutions of higher and secondary special education.

Types of professional activity:

Graduates of the Bachelor's degree in EP 6B07201 "Oil and gas and ore geophysics" in accordance with their professional training can perform the following activities:

Organizational and managerial:

- planning and organization of geophysical works on licensed blocks and areas;
- selection and justification of scientific, technical and organizational solutions based on geological and geophysical data and economic calculations.

Production and technological:

- organization of the production process when performing field and borehole geophysical surveys;
- ensuring compliance of these studies with design estimates, technical requirements and safety rules;
- selection of methods, equipment and installations when performing geophysical research;
- effective use of methods and technical means, equipment, algorithms and programs for selecting and calculating parameters for performing field and borehole geophysical surveys.

Experimental research:

- collection and systematization of scientific and technical information of domestic and world experience in relation to solving problems of geophysical methods of prospecting and exploration of mineral deposits;
- numerical modeling of objects of geophysical research based on modern software;
- planning and conducting experimental and methodological geophysical works;
- regulation and adjustment of geophysical equipment and instrumentation;
- registration of various geophysical parameters. Ensuring the quality of receiving signals;
- quality control of the work performed.

Calculation, design and analytical:

- formation of the goals and objectives of the project (program), providing a modern level of field and borehole geophysical research;
- registration of technological documentation of geophysical research;
- collection and analysis of information source data for design;
- conducting a preliminary feasibility study of design calculations;
- development of design and estimate documentation for field and borehole geophysical research;
- implementation of projects in production and author's supervision
- participation in the assessment of the economic efficiency of production activities of personnel of geophysical parties and detachments;
- ensuring the safety of geophysical work.

2. The purpose and objectives of the educational program

Purpose of EP:

Training for research institutes, operators (subsurface users) and service companies of professionally educated and competent specialists who are able to effectively participate in studies of the structure of the Earth's crust and work in engineering and technical positions when conducting geological and geophysical research on prospecting, exploration and additional exploration of mineral deposits based on innovative methods and technologies (including software), using modern equipment, taking into account the principles of sustainable development.

Tasks of EP:

- study of a cycle of general education disciplines to provide social and humanitarian education based on the laws of socio-economic development of society, history, modern information technologies, the state language, foreign and Russian languages;

- study of the cycle of basic disciplines to provide knowledge of natural science, general technical and economic disciplines as the foundation of professional education;

- study of a cycle of profile disciplines focused on the study of key theoretical and practical aspects of the technique and technology of conducting onshore and borehole geophysical research for the purpose of rational use of natural resources;

- familiarization with the methods, technologies and equipment of operator and service companies during the period of production and pre-graduate practice;

- acquisition of skills and abilities to perform laboratory studies of core samples and reservoir fluid samples using modern computer technologies and programs;

- multi-aspect training of bachelors in modular programs of oil and gas and ore geology and geophysics, including in the framework of field practical classes on obtaining, processing and interpretation of geological and geophysical data, construction of geological and geophysical and field-geophysical models;

- training of competitive specialists in demand in the labor market, possessing a set of necessary knowledge and skills, including:

a) study of disciplines that form knowledge, skills and abilities of planning and organizing geophysical work;

b) acquisition of experience in carrying out research projects and skills in performing work in modern software.

The main outcomes of the educational program are:

1. *Professional knowledge and skills* that enable graduates to work in the field of exploration and extraction of natural resources using modern geophysical methods, with a focus on sustainable and rational use of natural resources.

2. *Ability to solve environmental and social problems* arising during the exploitation of deposits, taking into account the impact on the environment and climate.

3. *Innovative approaches in geophysics* aimed at improving the efficiency of natural resource use and minimizing negative consequences for ecosystems.

4. *Partnerships with various organizations* that ensure the integration of scientific knowledge and technologies with industry, contributing to improved results and the implementation of sustainable development practices.

Thus, the educational program 6B07201 "Oil and Gas and Mining Geophysics" actively contributes to achieving the United Nations Sustainable Development Goals by training students in skills that enable them to work effectively and responsibly in the field of geophysics.

3. Requirements for evaluating the educational program learning outcomes

The graduate of this EP is awarded the academic degree of Bachelor of Engineering and Technology.

A graduate of the Department of "Geophysics" according to OP 6B07201 "Oil and gas and ore geophysics" should know:

- goals and objectives of geophysics in the system of Earth sciences;
- be aware of the social significance of your future profession;
- have a high motivation to perform professional activities;
- be able to evaluate the capabilities of each geophysical method and navigate the applicability of individual methods;
- have the skills to work with geophysical equipment and geophysical data and have the skills to work with a computer as a means of information management.

Demonstrate the ability to work as part of a research team, participate in the preparation of reports, abstracts, bibliographies on the subject of scientific research, in the preparation of publications; willingness to work with geophysical data, 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 (in accordance with the profile of training); to participate in the organization of scientific and practical seminars and conferences.

The volume of the bachelor's EP is 248 credits, regardless of the form of study, the educational technologies used, the implementation of the bachelor's program using a network form, the implementation of the bachelor's program according to an individual curriculum, including accelerated learning.

The content of the EP 6B07201 "Oil and gas and ore geophysics" on the basis of the development of a multi-level system of personnel training, the fundamentals 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 oil and gas and ore geophysics, 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;

- preparation of bachelors for the oil and gas and mining industry who know the technology and methods of geophysical work, methods of processing, interpretation and modeling of the obtained geophysical data;

-training of professional and competitive specialists in the field of oil and gas and ore geophysics, capable of applying innovative methods in the search and exploration of mineral deposits;

- application of knowledge of fundamental and technical sciences, including mathematics, physics, chemistry;

-the use of methods of system analysis, in assessing the obtained geological and geophysical and field-geophysical data;

-знание современных проблем нефтегазовой и рудной геофизики;

- acquisition of practical skills of working with geophysical equipment, modern software for processing, interpretation and modeling of obtained geological and geophysical data using modern information technologies;

- the use of methods, skills and modern technical means necessary for the identification and prospecting of oil and gas prospective objects and deposits of solid minerals;

- ability to work with the necessary, updated literature, computer information, databases and other sources of information to solve the 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 bachelors of industrial and ethical responsibility, the ability to understand the problem from working together with various specialists, to find optimal solutions, the need to improve their knowledge and skills;

- readiness of bachelors for professional activity through disciplines that provide fundamental knowledge, skills and work skills in production, government organizations, research institutes and educational institutions;

- ability to analyze geological and geophysical data and monitor geophysical work, as well as to make management decisions based on their results;

- have erudition, knowledge of modern social and political problems, 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

№	Field name	Comments
1	Code and classification of the field of education	6B07 «Engineering, Manufacturing and Civil engineering»
2	Code and classification of training directions	6B072 «Manufacturing and processing»
3	Educational program group	B071 «Mining and mineral extraction»
4	Educational program name	6B07201 «Oil and gas and ore geophysics»
5	Short description of educational program	Designed for specialized training of bachelors in EP 6B07201 "Oil and gas and ore geophysics" NJSC «KazNRTU named after K.I.Satpayev». The bachelor's training program for OP 6B07201 "Oil and gas and ore geophysics" provides: a) training of specialists in the field of geophysical methods of prospecting and exploration of mineral deposits; b) obtaining by bachelors of high-quality knowledge on the stages and rational complexes of geological and geophysical research, organization and conduct of field and borehole geological and geophysical research, processing, interpretation and modeling of the data obtained; c) acquisition of skills in analyzing geological and geophysical data, structuring them, classifying target objects in mineral deposits; setting and solving direct and inverse problems in the search and

		exploration of mineral deposits.
6	Purpose of EP	Training for research institutes, operators (subsurface users) and service companies of professionally educated and competent specialists who are able to effectively participate in studies of the structure of the Earth's crust and work in engineering and technical positions when conducting geological and geophysical research on prospecting, exploration and additional exploration of mineral deposits based on innovative methods and technologies (including software), using modern equipment.
7	Type of EP	New
8	The level based on NQF	6
9	The level based on IQF	6
10	Distinctive features of EP	no
11	List of competencies of 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 Understanding and practical use of healthy lifestyle norms, including prevention issues, the ability to use physical culture to optimize performance GC -3 The ability to analyze the main stages and patterns of the historical development of society for the formation of a civic position GC -4 The ability to use the fundamentals of philosophical knowledge to form a worldview position GC -5 The ability to critically use the methods of modern science in practice GC -6 Awareness of the need and acquisition of the ability to independently study and improve their skills throughout their working life GC -7 The meaning and understanding of professional ethical standards, knowledge of the techniques of professional communication GC -8 Ability to work in a team, tolerantly perceiving social, ethnic, confessional and cultural differences GC -9 Ability to use the basics of economic knowledge in various fields of activity. **General Professional Competencies (GPC):** GPC -1 Ability to independently acquire new knowledge using modern educational and information technologies GPS -2 Possession of computer skills sufficient for professional activity and knowledge of professional programs GPC -3 Knowledge of the basic methods, methods and means of obtaining, storing, processing information, the ability to use modern technical means and information technologies to solve general professional tasks 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, willingness to interpret, structure and formalize information in a form accessible to others **Professional Competencies (PC):** PC 1 Ability to systematically study scientific and technical information, domestic and foreign experience in the geophysical profile of training PC 2 The ability to integrate applied sections of geophysics

		(including gravimagnetic exploration, geoelectrics, seismic exploration, mathematical geophysics, geophysical studies of wells) and specialized geological and geophysical knowledge (including physical processes occurring in the Earth) to solve problems of geology and geophysics; PC 3 Ability to participate in work on innovative projects using basic research methods. Possession of the skills of systematic logical thinking in the analysis of scientific data and the formulation of practical tasks of geophysical research; PC 4 Ability to review, analyze and generalize geological and geophysical information to select the main parameters of the field geophysical survey, conduct experimental and methodological work and optimize the methods of geophysical observations and knowledge of the methods of conducting field geophysical work in land, sea, aero and borehole variants; PC 5 The ability to independently set specific geophysical tasks and solve them based on the use of modern equipment, software and information technologies using the latest domestic and foreign experience; PC 6 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 results, freely and creatively use modern methods of analysis, processing and interpretation of complex geophysical information to solve practical problems; PC 7 Proficiency in professional operation of modern geophysical field and laboratory equipment (in accordance with professional training); determination of technical and technological parameters of equipment, equipment, materials and preparation of equipment for field work (setup, verification or testing, preventive maintenance); PC 8 Availability of skills in conducting field petrophysical studies from the preparation of equipment, rock samples (minerals) and core material to laboratory petrophysical studies to laboratory measurements of petrophysical parameters of rock samples and core material. Knowledge of the stages of processing and analysis of measurements of petrophysical parameters of rock samples and core material; PC 9 The ability to carry out metrological measures for the preparation of equipment, facilities and installations for measuring the physical parameters of rocks and ores with an acceptable error. Calibration and standardization of ground and downhole equipment designed to solve petrophysical problems.The ability to organize and conduct high-quality interpretation processing for linking and joint geological interpretation of the results of previous stages of processing borehole drilling, geophysical and petrophysical data. Organization of registration of processing results and their transfer to the customer; PC 10 Possession of computer software packages designed to work with a complex of geological and geophysical data (Petrel, Focus-Geolog, OazisMontaj, Studiorm, etc.). PC 11 Ability to analyze and apply the laws on subsoil and subsoil use, industrial safety and environmental Code, regularly monitor changes and additions to these laws; PC 12 The ability to identify and systematize the main ideas in scientific publications; critically evaluate the effectiveness of various approaches to solving geophysical problems; 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	ON1: use the physical foundations of geophysical methods and mathematical algorithms for analysis, modeling of hydrocarbon fields and solid mineral deposits when performing scientific and applied study in professional activities; ON 2: formulate differently, identify criteria, share with an individual opinion on the solution of geophysical problems, taking into account the latest domestic and foreign experience, based on an understanding of the main directions in the development of geophysical methods; ON 3: demonstrate knowledge of modern geophysical field and laboratory equipment and geological and technological capabilities of industry software and methodological sets, determine the technical parameters of the equipment and prepare it for field work (setting, verification or testing); ON 4: to demonstrate the skills of independent setting and solving geophysical problems; the integration of a priori information for evaluation the parameters of observation systems in land, sea, space, air and borehole versions for the preparation of project documentation for geophysical study based on business planning, anti-corruption policy and environmental and labor safety of life; ON 5: to demonstrate the skills of managing R&D and production job using modern equipment, instruments, software and information technologies based on the principles of entrepreneurship and leadership, anti-corruption policy and life safety; ON 6: to demonstrate the skills in working with computer software packages designed for the creative use of modern methods of analysis, processing, interpretation, modeling, graphing and mapping data from land, sea, air and borehole geophysics for scientific and practical problems; ON 7: critically analyze the results of processing, interpretation and modelling of geophysical data in according with research activities and system logical thinking, visualize the results of geophysical study based on comparison with complex data, formulate findings, scientific conclusions, give recommendations on identifying features of the geological structure for job target; ON 8: synthesize a priori information from published and archive data, interpret, model, systematize, structure and format information in an accessible form, apply reliable interpretation techniques for correlated and integrated geological interpretation of boreholes, drilling, geophysical and petrophysical data; compile and present the results in the form of geological reports; ON 9: to synthesize own ideas, results of scientific research and applied study in national or foreign publications in order to develop or form an independent view of the nature and structure of target objects on hydrocarbon accumulations and solid mineral deposits, taking into account the main directions in the development of geophysics, the integration of geophysical information and geological and field data; ON 10: to defend and prove your own at assessment of innovative domestic or foreign experience at the formation of an original judgment on a professional problem and conduct ethical

		interpersonal communication with public speaking skills and the ability to work in a team.
13	Education form	full - time
14	Period of training	4
15	Amount of credits	240
16	Languages of instruction	Russian/Kazakh
17	Academic degree awarded	Bachelor of Engineering and Technology
18	Developer(s) and authors:	1) Professor Abetov A.E., 2) Associate Professor Umirova G.K.

4.2. Relationship between the achievability of the formed learning outcomes based on educational program and academic disciplines

№	Name of the discipline	Brief description of the discipline	Number of credits	Generated learning outcomes (codes)									
				ON 1	ON 2	ON 3	ON 4	ON 5	ON 6	ON 7	ON 8	ON 9	ON 10
Cycle of general education disciplines Required component													
1	Modern history of Kazakhstan	It is intended to familiarize with the main theoretical and practical achievements of the national historical science on the problems of the history of modern Kazakhstan, a systematic study of the main stages of the formation and development of Kazakh society. The features of the history of Kazakhstan in the Soviet period will be analyzed; the historical content of the patterns of political, socio-economic, cultural processes at the stages of the formation of an independent state will be revealed; the civic position of students will be formed	5				v					v	v
2	Philosophy	The discipline is intended for the formation of a culture of philosophical thinking, the transfer of knowledge of a methodological nature. The training is aimed at assisting in choosing the right life orientations and solving life-meaning problems. The course focuses on the system of philosophical knowledge; - to teach them to navigate the history of philosophy; - to develop the ability to independently analyze and comprehend the fundamental issues of the worldview, which were constantly in the field of attention of philosophers and deeply exciting people today, at the beginning of the XXI century.	5				v					v	v
3	Foreign language	The course is designed to develop the skills to actively use in practice most aspects of the tenses of the English language, conditional sentences, phrases in the passive voice, etc. At this stage, the student will be able to maintain a conversation with several interlocutors or express his point of view. The student significantly expands his vocabulary, which will allow him to freely express his thoughts in any situation. At the same time, the speech will be replenished with various synonyms and antonyms of already familiar words, phrasal verbs and stable expressions.	10				v					v	v

4	Kazakh (Russian) language	The course covers: alphabet, sounds and letters, phonetic and intonational means of language, basic word-formation, morphological and syntactic units and conditions of their use. Considers: listening, reading, writing and speaking. The course presents a lexical minimum, the assimilation of which is necessary for adequate communication in current communication situations. It is aimed at acquiring the skills of reading, writing and understanding of sounding speech on the basis of simultaneous mastering the basics of grammar and word usage in the course of constant repeated repetition with a gradual complication of tasks.	10				v					v	v
5	Information and communication technologies (in English)	The course information and communication technologies examines modern methods and means of communication of people in ordinary and professional activities using information technologies for the search, collection, storage, processing and dissemination of information	5				v					v	v
6	Module of socio-political knowledge (sociology, political science)	The course is devoted to the study of general political, sociological and psychological knowledge for bachelors of technical direction. Examines: political self-awareness, improvement of one's political outlook and communicative competencies; basic sociological theories and the most effective ways of developing sociological imagination, understanding the basic concepts of sociology as a science	3				v					v	v
7	Module of socio-political knowledge (cultural studies, psychology)	Cultural studies considers the foundations for the study of the entire complex of social sciences and humanities, as well as a supplement to general courses in history and philosophy. The course includes the following questions: morphology, semiotics, anatomy of culture; culture of nomads of Kazakhstan, cultural heritage of Proto-Turks, medieval culture of Central Asia, formation of Kazakh culture, Kazakh culture in the context of globalization, cultural policy of Kazakhstan, etc. based on the application of psychology in practice, in various spheres of life: personal, family, professional, business, public, in working with people.	5				v					v	v
8	Physical Culture	The course is devoted to the formation of physical culture of the individual and the ability to direct the use of various means of physical culture to preserve and strengthen health.	8				v					v	v

Cycle of general education disciplines **University component**													
9	Fundamentals of anti-corruption culture and law	The course introduces students to the improvement of socio-economic relations of Kazakhstan society, psychological features of corrupt behavior. Special attention is paid to the formation of an anti-corruption culture, legal responsibility for acts of corruption in various spheres. The purpose of studying the discipline «Fundamentals of anti-corruption culture and law» is to increase public and individual legal awareness and legal culture of students, as well as the formation of a knowledge system and a civic position on combating corruption as an antisocial phenomenon. Expected results: to realize the values of moral consciousness and follow moral norms in everyday practice; to work on improving the level of moral and legal culture; to use spiritual and moral mechanisms to prevent corruption.	5				v	v					v
10	Fundamentals of scientific research methods	Introduction. Science and scientific thinking. Basic concepts. The main categories of science. Science as a system of knowledge. Fact, hypothesis, theory, con-cept. Methodology, method, methodology. Scientific research. Technology of research work. Stages of scientific research. Technology of working with sci-entific literature. Presentation of research results. System approach, system thinking, system analysis. General logical methods of research. Organization of scientific activity and scientific re-search. Implementation of the results of scientific research. Economic effi-ciency of scientific research.	5	v	v					v	v	v	v
11	Fundamentals of economics and entrepreneurs hip	Discipline studies the foundations of economics and entrepreneurial activity from the point of view of science and law; features, problematic aspects and development prospects; the theory and practice of entrepreneurship as a system of economic and organizational relations of business structures; The readiness of entrepreneurs for innovative susceptibility. The discipline reveals the content of entrepreneurial activity, the stages of career, qualities, competencies and responsibility of the entrepreneur, theoretical and practical business planning and economic examination of business ideas, as well as the analysis of the risks of innovative development, the introduction of new technologies and technological solutions.	5				v	v	v				v

12	Ecology and life safety	The discipline studies the tasks of ecology as a science, environmental terms, the laws of the functioning of natural systems and aspects of environmental safety in the conditions of labor activity. Monitoring of the environment and management in the field of its safety. Sources of pollution of atmospheric air, surface, groundwater, soil and ways to solve environmental problems; life safety in the technosphere; natural and man-made emergencies	5				v	v					v
13	Basics of Financial Literacy	Using in practice all kinds of tools in the field of financial management, saving and increasing savings, competent budget planning, obtaining practical skills in calculating, paying taxes and correctly filling out tax reports, analyzing financial information, orienting in financial products to choose adequate investment strategies.	5				v	v					v
Cycle of basic disciplines **University component**														
14	Mathematics I	The course is devoted to the study of the basic concepts of higher mathematics and its applications. The main provisions of the discipline are applied in the teaching of all general education engineering and special disciplines taught by graduate departments. The course sections include elements of linear algebra and analytical geometry, an introduction to analysis, differential calculation of functions of one and several variables. Methods for solving systems of equations, problems of using vector calculations in solving problems of geometry, mechanics, and physics are considered. Analytical geometry on a plane and space, differential calculation of functions of one variable, derivatives and differentials, study of the behavior of functions, derivative and gradient in direction, extremum of a function of several variables.	5	v			v						
15	Physics I	Objectives: to study the basic physical phenomena and laws of classical, modern physics; methods of physical research; the relationship of physics with other sciences. The following topics are considered: mechanics, dynamics of rotational motion of a solid body, mechanical harmonic waves, fundamentals of molecular kinetic theory and thermodynamics, transport phenomena, continuum mechanics, electrostatics, direct current,	5	v					v				

		magnetic field, Maxwell equations.											
16	Physics II	The course studies the laws of physics and their practical application in professional activity. Solving theoretical and experimental-practical educational problems of physics for the formation of the foundations in solving professional problems. Assessment of the degree of accuracy of the results of experimental or theoretical research methods, modeling of physical condition using a computer, study of modern measuring equipment, development of skills for conducting test studies and processing their results, distribution of the physical content of applied tasks of the future specialty.	5	v					v				
17	Mathematics II	The discipline is a continuation of Mathematics I. sections of the course include integral calculus of a function of one variable and several variables, series theory. Indefinite integrals, their properties and methods of their calculation. Certain integrals and their application. Incorrect integrals. Numerical series theory, functional series theory, Taylor and Macloren Series, application of series to approximate calculations.	5	v			v						
18	Mathematics III	The discipline is a continuation of Mathematics II. The course includes sections: ordinary differential equations and elements of probability theory and mathematical statistics. Differential equations with separable variables, homogeneous, in full differentials, linear inhomogeneous differential equations with constant coefficients, systems of linear differential equations with constant coefficients, finding the probability of events, calculating the numerical characteristics of random variables, using statistical methods for processing experimental data are studied.	5	v			v						
19	Engineering and computer graphics	The discipline is aimed at the study of methods for the image of objects and the general rules of drawing, using computer graphics; the study of the basic principles and geometric modeling approach and methodology for developing applications with a graphical interface; the formation of skills in the use of graphic systems for the development of drawings, using 2D and 3D modeling methods	5						v	v	v		
20	General and structural geology	The discipline examines the issues of the material composition of the Earth; geodynamic processes, forms of occurrence of rocks, patterns of their location and combination, geological conditions of formation, discontinuous disturbances, general patterns of	4							v	v	v	v

		development of the Earth's crust. The issues of organization and production of geological survey work, application of geophysical methods in geological mapping are considered. Methods of drawing up and reading geological, tectonic and structural maps, geological sections, flowcharts, stratigraphic columns, geodynamic profiles, computer models are considered.											
21	Mineralogy and petrography	Basic concepts: mineral species, variety, individual, crystal, aggregate. Basic properties of the substance. Crystal structure: faces, edges, crystal symmetry. Elements of symmetry, syngony, simple shapes. Structure and chemical composition of minerals. Polymorphism, isomorphism. Physical and optical properties of minerals. Petrography as a science, rocks, their classification and methods of study. Sedimentary igneous and metamorphic rocks. Their classification and characterization according to the conditions of formation, structures, textures and mineral composition. Industrial applications	6							v	v	v	v
22	Exploration Geophysics	The discipline studies the internal structure of the Earth to search for and detail the structure of mineral deposits, as well as criteria for their formation using various geophysical methods. The physical characteristics of geophysical fields and the basics of their theory, methods of measuring geophysical fields, principles of operation of geophysical equipment and its main characteristics, methods of processing and interpretation of geophysical information, a range of geological and geophysical problems solved by methods of exploration geophysics are considered.	5	v	v	v			v	v	v	v	
23	Oil and gas geology	Oil and gas, and their physical properties. Genesis of petroleum. Migration of petroleum. Collection of oil and gas. Porosity. Permeability. Natural reservoirs of oil and gas. Deposits of oil and gas. Fields of oil and gas. Geophysical and geochemical methods of search for oil and gas geological structure and petroliferous of sedimentary basins of Kazakhstan. Distribution of oil and gas reserves in earth core. Characteristic of zone of oil And gas resources.	5	v						v	v		
24	Theory of field	The course examines the basic laws of propagation of electromagnetic, thermal, radiation and acoustic fields in various environments and their mathematical description Discusses the basic concepts of the field theory, the theoretical foundations of	5	v					v				

		the gravitational, electric, electromagnetic fields, as well as elastic stresses and strains in a solid. Sections of the discipline are devoted to the basic processes of propagation of fields in the environment and their interaction with matter, as well as mathematical descriptions of these processes.											
25	Geophysical exploration (well logging) of uranium deposits	Considers the physico-geological basis and the effectiveness of GIS methods in the search and exploration of uranium deposits. It is based on the study of the geological section of the well, the lithological and stratigraphic dissection of sections, the isolation of uranium deposits, the determination of their filtration-capacitance properties and inter-well correlation. Studies the geochemical and nuclear-physical properties of uranium, geophysical methods of research in wells during the exploration and development of uranium deposits by the method of underground borehole leaching.	5	v	v	v			v			v	
26	Methods of electric reconnaissance on a constant and alternating electric current	The course is designed to prepare bachelors with basic knowledge of the theory and practice of methods of electrical exploration on direct and alternating current. Classification of electrical exploration methods and efficiency of electrical exploration. Petrophysical basis of electrical exploration. Theory of electrical exploration. Direct and inverse problems of electrical exploration. Electrical exploration installations of direct current. The DC potential and field of one and two sources. Methods of alternating current. The influence of the earth's surface. The principle of equivalence.	5		v	v			v		v	v	
27	Petrophysics	Designed to study the physical and mechanical properties of rocks. Petrophysical quantities (density, porosity and permeability coefficients, electrical conductivity, magnetization, radioactivity, etc.) are considered. The dependences of petrophysical characteristics on the main physical processes in rocks, the conditions of formation and occurrence of geological objects, the relationship of reservoir, magnetic, electrical, elastic, thermal, nuclear physical properties, the role of petrophysical parameters in the interpretation of geophysical data in solving geological problems are studied.	5		v				v	v	v	v	
28	Theoretical foundations	The fundamentals of measurement of geophysical data, equipment and geophysical information of digital format characterizing	5	v	v	v			v	v	v	v	

	of geophysical data processing	quantitative information about any physical property, physical field or phenomenon of the geological environment, geological object are considered; issues of extracting useful information from the measurement results of individual geophysical methods (mainly seismic exploration) and their complexes. A number of linear transformations aimed at filtering and analysis in order to suppress interference, isolate and separate useful signals (anomalies) are studied.											
29	Modern geophysical technologies for calculating reserves of uranium deposits	The course studies GIS methods in the exploration and development of uranium deposits, the methodology for assessing the radioactive equilibrium in uranium ores, the principles of delineation of ore deposits, the methodology for determining the boundaries and capacity of ore bodies, the specifics of calculating the reserves of uranium deposits. The basics of interpretation of GIS diagrams, assessment of filtration properties of rocks are considered. Based on the geophysical support of the method of underground borehole leaching of uranium, the principles of calculating the reserves of uranium deposits by the method of geological blocks are given	5	v	v	v				v	v	v	
30	Introduction to building 3D physical and geological models for calculating hydrocarbon reserves	The course is designed to introduce students to modern technologies for calculating reserves and estimating hydrocarbon resources based on the construction of 3D physical and geological models. The following questions are considered: substantiation of categories and groups of reserves and resources of hydrocarbons; the concept of reserves and resources; main and associated minerals, associated useful components; determination of parameters for calculating reserves by various methods; software tools for building 3D physical and geological models for calculating reserves and estimating the resources of associated components.	5						v	v	v		
31	Basics of Artificial Intelligence	The course considers optimization algorithms based on simulation of natural processes in living and non-living nature, expert systems, clustering algorithms that provide personalized user service, prediction methods based on regression models, neural networks of direct distribution.	5		v	v	v	v	v		v	v	v

32	The internal structure of the Earth, physical processes and properties	The course examines methods for studying the internal structure and composition of the Earth. Issues under consideration: geological and geophysical methods. Features and disadvantages of geological methods. The study of the deep structure of the Earth based on the patterns of change with depth of various physical parameters (electrical conductivity, magnetic susceptibility, density, etc.). The results of seismic research are the basis for developing models of the internal structure of the Earth. The main internal geospheres of the Earth. The borders of Mohorovic and Gutenberg. Composition and types of the earth's crust. Geophysical characteristics of the Earth. Distribution of mass between the inner geospheres.	5		v				v	v	v		v
33	Legal regulation of intellectual property	The discipline covers the basics of IP law, including copyright, patents, trademarks, and industrial designs. Students learn how to protect and manage intellectual property rights, and consider legal disputes and methods for resolving them.	5		v				v	v	v		v
34	Geoinformation systems in geology and geophysics	The discipline studies the capabilities of geoinformation systems (GIS) in solving geological and geophysical problems, acquiring skills in processing and interpreting geophysical data. Collection and analysis of geological and geophysical information. Compilation of a database based on a priori data. The study of specialized software tools (ArcGIS) for processing and interpreting geological and geophysical data. Transformation of geological and geophysical information for visualization in order to further complex interpretation.	5				v	v	v	v	v		
35	Educational practice	It is intended for conducting field geophysical methods based on knowledge of the physical basics of methods, the range of tasks to be solved, types of surveys, the principle of operation and device of equipment and geophysical equipment. Students will get acquainted with the design of field geophysical methods, learn how to test and calibrate equipment, conduct field measurements, get an idea of primary processing, construction of work results in the form of maps, graphs and sections.	2	v	v				v		v		

Cycle of basic disciplines Component of choice													
36	Fundamental Physics of Earth	Forms theoretical knowledge about the physical processes occurring in the bowels of the Earth, its structure, evolution and methods of study in order to use it as a theoretical basis for interpreting geophysical data. A general idea of the internal structure of the Earth, the concept of the origin and structure of the Earth's shells, the physical properties of rocks, the theory of the emergence of the gravitational, electromagnetic, thermal and radioactive fields of the Earth and their structure are considered. The course studies seismicity, the causes of earthquakes, the hazards associated with them, and the possibilities of seismic earthquake prediction.	5		v				v	v	v		v
37	Fundamental gravity survey	One of the main methods of solving geological problems: geocarting, searching for structures, their detailed volumetric study, to which deposits are confined. Newton's theory of gravity, as the mathematical basis of gravity exploration, serves as the fundamental foundation of the science of the laws of spatial propagation of any physical fields. Therefore, the study of the course "Gravity Exploration" is necessary not only to master the method itself, but also to facilitate understanding of the laws of gravitational, magnetic and electric fields that are excited by geological bodies.	5	v	v				v	v			v
38	Fundamentals of sustainable development and ESG projects in Kazakhstan	Introduces the principles of sustainable development and the implementation of ESG practices in Kazakhstan, includes the study of national and international standards, analysis of successful ESG projects and strategies for their implementation in enterprises and organizations.	5		v		v	v	v		v	v	v
39	Theoretical foundations of magnetic exploration	The course covers the basics of magnetometry and explores the principles of solving geological problems based on magnetometric data. Considers the following questions: magnetic field (normal and anomalous fields, modern ideas about the origin of the field), induction, magnetization, genesis and types of magnetization, susceptibility. Types of magnets. Elements of the Earth's magnetic field and their variations. Methods for measuring the parameters of the magnetic field and magnetic exploration equipment. Magnetic	6	v	v				v	v			v

		exploration technique, types of surveys, observation networks, measurement error, control points and point. Introduction to the interpretation of magnetic anomalies and the application of magnetic prospecting.											
40	Methods of studying of the Earth gravitational field	The course examines a brief theory of the Earth's gravitational field, acceleration and the potential of gravity, its first and second derivatives. Methods of measuring elements of the gravitational field, technical features and the principle of operation of gravitational devices are studied. Expanding the range of geological tasks by improving the technique and technology of field gravimetric work. Conducting field gravimetric studies when studying the shape of the Earth, searching for mineral deposits, identifying deep cracks and global tectonic structures.	5	v	v	v			v	v	v		v
41	Radiometry and nuclear geophysics	The course is designed to study the physical foundations of traditional methods of nuclear geophysics (field and laboratory) for use in geological and geophysical research to solve geological and in the search for mineral deposits. The sections of the course include ideas about the fundamentals of nuclear and geophysical methods, about the structure of nuclei, radioactive transformations, ionizing radiation, their excitation and measurement. Special attention is paid to the types of nuclear geophysical equipment and work with it, the methodology of methods and techniques for interpreting the results of nuclear geophysical research.	4	v	v	v		v					v
42	Theoretical basis, registration and processing of seismic data	The course studies the fundamental physical and geological foundations of seismic exploration, the principles of operation of seismic equipment, the methods and technologies used, procedures and algorithms for computer processing of seismic data. The dynamic theory of elasticity is being studied; kinematics and dynamics of elastic waves in layered media, principles of geometric seismic exploration (principles of Huygens, Fresnel, Fermat and superpositions), types, techniques and equipment of field seismic exploration, principles of obtaining seismic information, incl. design of seismic observation systems; seismic data processing graph procedures.	5		v	v			v	v	v	v	
43	Seismic 1 (Field seismic	The course considers applied aspects of the theory of propagation of elastic vibrations and processing of seismic waves, seismic equipment, sources of vibrations and field observation systems. The study of the course is focused on the methods and modifications of seismic surveys,	5		v	v			v	v	v	v	

	exploration and data processing)	practical problems to be solved for the use of interference systems in seismic surveys, analog and digital vibration registration systems. Applied aspects of seismic exploration technologies common deep point CDP-2D, 3D, 4D, deep seismic sounding, refracted wave method, vertical seismic profiling, seismic logging are considered; digital recording of seismic signals and telemetric seismic recording systems, design of surveillance systems, processing graph.											
44	Modern apparatus and equipment for seismic exploration	The course is designed to study modern achievements in the field of equipment and seismic exploration. The following questions are considered: composition of seismic equipment; sources of elastic waves; composition of the source of elastic waves; submersible and surface sources; source type: condensed explosives (explosives); gas detonation installations; vibroseismic platforms. geophones and piezo receivers (hydrophones); interference systems for receiving and excitation of elastic waves; composition of seismic stations; digital multichannel stations; the concept of a hardware complex	4		v	v			v	v	v	v	
45	Magnetometry 1 (physical and geological principles of magnetometry)	The course studies the theoretical foundations of magnetic exploration, the structure and laws of the earth's magnetic field, physical and geological prerequisites for the use of magnetic exploration in solving geological problems. The sections of the discipline include: physical and theoretical foundations of the magnetometric method, the principles of measurement of magnetic field elements and the theory of magnetic exploration equipment, mathematical support of existing methods of preparing information for processing of magnetometric data. Describes the experience of application of magnetic survey at the solution search (hydrocarbons, ore) and kartirovanija tasks.	6	v	v	v			v	v	v	v	
46	Methods of processing and interpretation of magnetic anomaly data	Acquisition of knowledge on the processing and interpretation of magnetic exploration data for solving geological problems in the search and exploration of MPI. Application of the acquired knowledge to solve the direct and inverse problems of magnetic exploration, separation of the magnetic field into transformants, principles and methods of interpretation of magnetic data, averaging, approximation, calculation of higher derivatives, continuation of anomalies as harmonic functions. Acquisition of competencies in the procedures of processing and interpretation of the observed magnetic field.	5		v	v		v	v	v	v		

Cycle of profile disciplines University component													
47	Methods for interpretation gravitational anomalies and the objects parameters evaluation	Studies the issues of geological interpretation of gravimetric data. The basis of the discipline is the petrophysical justification for the preparation of data for qualitative and quantitative interpretation. The principles of joint analysis with geological and structural maps, geological sections constructed from drilling data, and laboratory density determination data for rocks are considered. A special place is given to the methods of field transformations, solving direct and inverse problems, and obtaining additional information about the geological nature of gravitational anomalies.	4	v	v				v	v			v
48	Methods of interpretation of electromagnetic fields and application of electrical prospecting in solving geological and geophysical problems	Basic ideas of processing and interpretation of electrical exploration data. Electrical properties of rocks and ores. Direct and inverse problems. The concept of inversion. Physical and mathematical foundations of processing and interpretation, modern interactive software for electrical exploration data. Acquisition of knowledge about the physical foundations of electrical exploration, technology for measuring elements of the electromagnetic field of artificial and natural nature, gaining skills in geophysical and geological interpretation of electrical exploration data.	4	v				v	v	v	v	v	v
49	Theoretical basis for searching and exploration of oil and gas fields	The theoretical foundations of methods of prospecting and exploration of hydrocarbon deposits (oil, gas, condensates), as well as the main complex of geological and geophysical studies during prospecting and exploration are considered. The stages of geological exploration for oil and gas are being studied. Classification of wells, in accordance with regional, prospecting, evaluation, exploration and development of oil and gas fields. The methods of prospecting and exploration for oil and gas types of deposits are considered.	5	v			v					v	v
50	Well logging 1(Geophysical methods of oil and gas wells research)	The study of the physical foundations of electrical, radioactive, acoustic and other logging methods in oil and gas wells, the use of the results of the interpretation of logging curves in order to determine the calculation parameters of reservoir formations. Consideration of a rational well logging complex for lithological dissection of the section, allocation of productive horizons and determination of fishing parameters. Acquisition of competencies in the interpretation of logging methods, construction of computer models of reservoir layers.	6			v	v			v	v	v	

51	Production practice I	The first industrial practice is the initial immersion of young specialists into the production environment and provides for the participation of bachelors in the process of preparing, organizing and conducting field geophysical work from collecting documentation for participation in the tender to writing a report explanatory note. Bachelors can participate in prospecting, exploration geophysical research and desk work, as well as in geodetic support of geophysics, in borehole research.	2										v
52	Industrial practice II	It is a continuation of the production practice I. In the course of practical training, students gain professional skills, get acquainted with the stages, organization and management of geological exploration, features of geophysical research, introduction into field life during the survey, gain experience in organizational, social, educational and professional work.	3										v
Cycle of profile disciplines **Component of choice**													
53	Ecological Geophysics	The discipline studies the solution of geoecological problems in combination with geological, geochemical, hydrogeological, engineering and survey and other methods. Types of events: emergency oil spills, leaks from main product pipelines, flooding of territories, monitoring of pollution of industrial and civil facilities, etc. Natural and artificially created geophysical fields in the Earth's crust (gravitational, magnetic, electromagnetic, seismic, thermal, radiation). Methods and methods of observations of geophysical fields, innovative methods of solving geoecological problems. Integration of ground-based, aero- and remote methods for solving geoecological problems.	5		v		v	v					
54	Technogenic geophysics	Study of factors and patterns of formation of dangerous natural and man-made processes and phenomena; the impact of processes on the environment. Study of the history of global technogenic processes and catastrophes of the Earth associated with hydrometeorological causes, methods of accounting for dangerous processes associated with human activity in the life of the population. Application of methods in the design and operation of water management and agricultural systems, as well as the formation of a hydrographic network and river systems.	5		v		v	v					
55	Introduction to Seismology	The discipline studies the initial information on the internal structure of the Earth and the methods of seismology intended for its study. The laws of distribution of seismicity manifestations on the territory of Kazakhstan and the world are considered. Existing	5					v	v	v			v

		hypotheses and theories about the occurrence of earthquakes. Problems and trends of seismology. The basic terminology, concepts and essence of general seismology. Drawing up zoning schemes, analysis of seismic hazard and prediction of earthquake consequences. Earthquake forecast											
56	Theory and practice of project management	The discipline is aimed at studying the general trends of project management in market conditions in order to increase productivity in the professional industry. The essence, concept, composition, tasks and problems of management. Study of the scientific methodology of project management. The concept of organization, the external and internal environment of the team, communication. Requirements for project management. The role of decision-making in project management. The concept of anti-crisis programs in the performance of managerial functions. The concept of management culture and professional etiquette.	5				v	v					v
57	Theory of elasticity	Prerequisites: Earth physics, petrophysics, field theory The discipline is the physical and mathematical basis of seismic exploration and is intended to study the foundations of the theory of elasticity. Elastic waves in boundless and layered media. Features of the propagation of seismic waves in real environments. Theory of deformations and stresses. Relations between the components of the strain tensor and the stress tensor. Elastic constants and other equations of the theory of elasticity. Hooke's law. Application of the theory of elasticity in solving practical problems.	4				v	v					v
58	Interpretation and modeling based on seismic data	The discipline studies the basics of interpretation and modeling of seismic data and solving the inverse problem of seismic exploration; seismo-acoustic information content of well logging data and geological and technological capabilities of modern software and methodological complexes for the presentation of seismic information, joint visualization and interpretation of well logging and seismic data. The issues of seismic imaging of geological environments, construction of reflective and refractive boundaries according to travel time curves, time sections and cubes, seismic drift are considered; identification of tectonic disturbances, breaks and disagreements; seismic mapping; horizon correlations on time sections.	6			v			v	v	v		

59	Seismic 2 (Seismic data interpretation)	The course studies the methods of mathematical interpretation of seismic data and the application of mathematical modeling of the acoustic field in order to solve geological problems. Physical bases of procedures and algorithms for computer interpretation of seismic data are considered: stratigraphic referencing, structural interpretation and seismic resolution; methods of attributive analysis, inversion and AVO/AVA analysis, quantitative prediction of reservoir properties using seismic data. Ways are being studied to maximize the introduction of computerized systems, graphical modeling for the management of exploration technologies based on seismic data.	6			v			v	v	v		
60	Computer technologies in geophysics	The course studies the basics of computer-based solution of geological problems of prospecting and exploration of MPI using geophysical methods. The use of computer software in the measurement, processing and interpretation of geophysical data. Methods and technologies for optimal receipt, collection, storage, conversion and sending of data. Modern technologies of calculation of methods of supervision, automation of design of systems are studied; modern information technologies that implement the processing and mathematical interpretation and modeling of geological and geophysical information at various stages of geological exploration.	5					v	v	v	v	v	v
61	Computer technologies for modeling solid mineral deposits	The course is devoted to the study of computer technologies used in the modeling of deposits of solid minerals. Computer technologies for calculating statistical and spectral-correlation parameters of geophysical data. The method of probabilistic-statistical approach. The program "CASCADE 3D". Exchange of information between different processing systems, fragmentation, integration and addition of networks, interpolation and extrapolation of geofields, algebraic transformations over features. REIST technology. Purpose, construction of a model of a subhorizontal layer with laterally varying magnetization and density. Additional geological and geophysical information for modeling.	5					v	v	v	v	v	v
62	Magnetic exploration 2 (processing	"Processing and interpretation of magnetic data" is an important and high-tech stage in the application of magnetic exploration to solve geological problems of mapping, prospecting and exploration	5		v	v		v	v	v	v		

	and interpretation of magnetic exploration data)	of ore minerals, hydrocarbons and non-metallic raw materials. The content of the course provides for the theory and practice of studying the structure (composition) of the earth's magnetic field, the division of the field into components and its transformations, principles and methods of interpretation of magnetic data. The objects of study are the magnetic fields of geological structures and their different transformations used to solve geological problems.											
63	Underground geophysics	The course studies the composition, structure and condition of rocks in wells and mine workings. Issues under consideration: distribution of natural and artificial electric, magnetic, gravitational, thermal and other physical fields below the earth's surface. Borehole and mine geophysics. Registration parameters in the methods of borehole and mine magnetic prospecting and gravity prospecting. Methods of well and mine seismic survey: vertical seismic profiling (VSP), seismic and acoustic transillumination, underground seismic profiling, seismoelectric profiling and transillumination. Thermal exploration and underground registration of cosmic radiation. Application of underground geophysics.	4	v	v					v		v	
64	Introduction to the integration of geophysical methods	The course studies the initial information on the integration of geophysical methods. The reasons of aggregation, the ambiguity of modeling, the sources of obtaining information about the main parameters of the studied objects, the goals and principles of aggregation, the assessment of the degree of reliability of interpretation are considered. Typical, rational complexes of geophysical methods. Terms and sequence of physical and geological modeling (FGM). Classification of FGM. The conditions of applicability and the standard error of field geophysical work. Joint solution of the inverse problem for several geophysical fields. Integration in the search for minerals at various stages of work.	5	v	v		v			v	v	v	v
65	Integrated approach to the interpretation of geophysical data	The course studies the theory of rational integration of geophysical methods in the search and exploration of mineral deposits, studies of the deep structure of the Earth. Rational complexes for different types of minerals, analysis of the quality of geophysical information, principles of interpretation for individual geophysical methods, the use of statistical characteristics to establish links between different parameters of the methods of study are	5	v	v				v	v	v	v	

		considered.; construction of quantitative physico-geological models for solving geological mapping, prospecting, exploration, engineering and environmental problems.											
66	Theoretical bases and applied aspects of well logging (in wells drilled for solid minerals)	The course studies GIS methods used in the exploration, search and development of ore deposits. Physical properties of ore minerals and ores, solved geological problems and methods of conducting a complex of GIS methods in wells drilled for solid minerals. Determining the percentage of metal in ores and studying the structure of ore bodies in the inter–well space is the main task of GIS at TPI. The use of GIS complex in ore deposits of various types.	5	v	v				v	v	v	v	
67	Well logging 2 (Geophysical studies of wells for solid minerals)	The course studies GIS methods for solid minerals. The physical foundations of electrical, radioactive, acoustic and other methods of geophysical research of wells, the technique and technology of conducting research in ore wells are considered. The range of geological and technical problems solved by GIS in an ore well is studied. A rational well loggingcomplex is considered to clarify the geological section of wells; lithological dissection of rocks; isolation of ore layers; identification and tracing of tectonic disturbances; the structure of ore bodies; determination of useful components in ores.	5	v	v				v	v	v	v	
68	Introduction to forecasting a geological section based on seismic data	The discipline is aimed at acquiring initial knowledge about the methodology, hardware technologies and specialized software for forecasting a geological section (PGR). Relevance, essence, tasks and main elements of the PGR. The physical foundations of seismic methods and requirements for the seismic survey methodology at PGR. Features of processing and interpretation of seismic data for PGR and seismostratigraphy. Seismogeological modeling for solving PGR problems. The effectiveness of using the results of seismic exploration to solve the problems of PGR and seismostratigraphic analysis	6			v			v	v	v	v	v
69	Geological modeling of formations and forecasting of properties of oil and gas reservoirs by geophysical methods.	The course studies the basics of geological modeling in oil and gas fields. A brief theory of the construction of a geological and filtration model. The sequence of construction of geological and technological models. The essence, terms, concepts, advantages and disadvantages of modeling. Ways to build maps using a computer. Analysis of geological and commercial information for completeness and reliability. Identification and evaluation of commercial objects Methods of substantiation of water-oil contact. The method of computer calculation of stocks.	5						v	v	v	v	

5. Curriculum of educational program

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

SATBAYEV UNIVERSITY

APPROVED
Chairman of the Management Board -
Rector of Kazntu named after K.Satpayev
M.M. Begentayev
2024

CURRICULUM
of Educational Program on enrollment for 2024-2025 academic year

Educational program 6B07201 - "Oil and gas and ore geophysics"
Group of educational programs B071 - "Mining and production of affordable products"

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

Discipline code	Name of disciplines	Cycle	Total amount in credits	Total hours	classroom volume of lek/lab/pr	SIS (including TSIS) in hours	Form of control	Allocation of face-to-face training based on courses and semesters							
								I course		II course		III course		IV course	
								1 semester	2 semester	3 semester	4 semester	5 semester	6 semester	7 semester	8 semester
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)															
M-1. Module of language training															
LNG 108	Foreign language	GED, RC	5	150	0/0/3	105	E	5							
LNG 108	Foreign language	GED, RC	5	150	0/0/3	105	E		5						
LNG 104	Kazakh (russian) language	GED, RC	5	150	0/0/3	105	E	5							
LNG 104	Kazakh (russian) language	GED, RC	5	150	0/0/3	105	E		5						
M-2. Module of physical training															
KFK 101-104	Physical Culture	GED, RC	8	240	0/0/8	120	Diferedit	2	2	2	2				
M-3. Module of information technology															
CSE 677	Information and communication technology	GED, RC	5	150	2/1/0	105	E			5					
M-4. Module of socio-cultural development															
HUM 137	History of Kazakhstan	GED, RC	5	150	1/0/2	105	SE	5							
HUM 132	Philosophy	GED, RC	5	150	1/0/2	105	E			5					
HUM 120	Module of socio-political knowledge (sociology, political science)	GED, RC	3	90	1/0/1	60	E			3					
HUM 134	Module of socio-political knowledge (cultural studies, psychology)		5	150	2/0/1	150	E				5				
M-5. Module of anti-corruption culture, ecology and life safety base															
HUM 136	Fundamentals of anti-corruption culture and law	GED, CCH	5	150	2/0/1	150	E				5				
MNG 489	Fundamentals of economics and entrepreneurship														
PET 519	Fundamentals of scientific research methods														
CHE 656	Ecology and life safety														
MNG 564	Basics of Financial Literacy														
CYCLE OF BASIC DISCIPLINES (BD)															
M-6. Module of physical and mathematical training															
MAT 101	Mathematics I	BD, UC	5	150	1/0/2	105	E	5							
PHY 111	Physics I	BD, UC	5	150	1/1/1	105	E	5							
PHY112	Physics II	BD, UC	5	150	1/1/1	105	E		5						
MAT 102	Mathematics II	BD, UC	5	150	1/0/2	105	E		5						
MAT 103	Mathematics III	BD, UC	5	150	1/0/2	105	E			5					
M-7. Module of basic training															
GEN 429	Engineering and computer graphics	BD, UC	5	150	1/0/2	105	E		5						
AAP 173	Educational practice	BD, UC	2						2						
M-8. Geological and geophysical module															
GEO198	General and structural geology	BD, UC	4	120	2/1/0	75	E	4							
GEO490	Mineralogy and petrography	BD, UC	6	180	2/2/0	120	E			6					
GPH184	Exploration geophysics	BD, UC	5	150	2/1/0	105	E				5				
GPH 183	Fundamentals of Earth Physics	BD, CCH	5	150	2/1/0	105	E			5					
GPH 441	The internal structure of the Earth, physical processes and properties														
MNG562	Legal regulation of intellectual property				2/0/1										
GPH486	Oil and gas geology	BD, UC	5	150	2/1/0	105	E				5				
GPH165	Field theory	BD, UC	5	150	2/1/0	105	E					5			
GPH130	Geoinformation systems in geology and Geophysics	BD, CCH	5	150	2/1/0	105	E				5				
GPH 442	Introduction to the construction of 3D physico-geological models for calculating hydrocarbon reserves														
CSE 831	Fundamentals of Artificial Intelligence				1/0/2										
GPH180	Geophysical study of uranium field wells	BD, UC	5	150	2/1/0	105	E					5			
GPH122	Methods of electrification in direct and alternating electric current	BD, UC	5	150	2/1/0	105	E					5			
GPH185	Petrophysics	BD, UC	5	150	2/1/0	105	E					5			
GPH174	Theoretical foundations of geophysical data processing	BD, UC	5	150	2/1/0	105	E					5			
GPH424	Methods of studying the Earth's gravitational field	BD, CCH	5	150	2/1/0	105	E					5			
GPH167	Theoretical foundations of gravitational exploration														
MNG563	Fundamentals of sustainable development and ESG projects in Kazakhstan				2/0/1										
GPH182	Modern geophysical technologies in calculating uranium deposit reserves	BD, UC	5	150	2/1/0	105	E						5		
GPH425	Radiometry and nuclear geophysics	BD, CCH	4	120	2/1/0	75	E						4		
GPH 443	Modern seismic survey equipment and equipment														
GPH428	Seismic 1 (Field seismic exploration and data processing)	BD, CCH	5	150	2/1/0	105	E						5		
GPH121	Theoretical foundations, registration and processing of seismic data														

GPH427	Magnetic exploration 1 (physical and geological bases of magnetic exploration)	BD, CCH	6	180	2/0/2	120	E							6		
GPH430	Theoretical foundations of magnetic exploration															
CYCLE OF PROFILE DISCIPLINES (PD)																
M-9. Module of professional activity																
GPH413	Methods for interpreting gravitational fluctuations and evaluating object parameters	PD, UC	4	120	2/1/0	75	E							4		
GPH456	Theoretical foundations of exploration and exploration of oil and gas fields	PD, UC	5	150	2/1/0	105	E							5		
GPH414	Methods of interpretation of electromagnetic fields and application of electroscopy in solving geological and geophysical problems	PD, UC	4	120	2/1/0	75	E							4		
GPH431	Well logging 1(Geophysical methods of oil and gas wells research)	PD, UC	6	180	2/0/2	120	E								6	
GPH151	Environmental geophysics	PD, CCH	5	150	2/1/0	105	E								5	
GPH173	Technogenic geophysics															
GPH166	Introduction to Seismology	PD, CCH	5	150	2/1/0	105	E								5	
NSE185	Theory and practice of Project Management				2/0/1											
GPH429	Seismic 2 (Seismic data interpretation)	PD, CCH	6	120	2/2/0	120	E								6	
GPH415	Interpretation and modeling of seismic data															
GPH421	Introduction to geological section forecasting based on seismic data (R&D Module)				2/0/2											
GPH426	Computer technologies in geophysics	PD, CCH	5	150	2/1/0	105	E								5	
GPH191	Computer technologies in modeling solid mineral deposits															
GPH190	Magnetic exploration 2 (processing and interpretation of magnetic exploration data)	PD, CCH	5	150	2/1/0	105	E									5
GPH169	Methods of processing and interpreting magnetic deviation data															
GPH192	Introduction to the complex of geophysical methods	PD, CCH	5	150	2/1/0	105	E									5
GPH172	A comprehensive approach to interpreting geophysical data															
GPH422	Geological modeling of layers and forecasting of the properties of oil and gas reservoirs by geophysical methods (R&D Module)															
GPH432	Well logging 2 (Geophysical studies of wells for solid minerals)	PD, CCH	5	150	2/1/0	105	E									5
GPH410	Theoretical bases and applied aspects of well logging (in wells drilled for solid minerals)															
GPH439	Theory of elasticity	PD, CCH	4	120	2/1/0	75	E									4
GPH440	Underground geophysics															
AAP102	Production practice I	PD, UC	2									2				
AAP183	Production practice II	PD, UC	3											3		
M-10. Final certification module																
ECA109	Writing and defense of the thesis / project	FA	8													8
M-11. Additional training module																
AAP500	Military training	ATT	0													
	Total based on UNIVERSITY:							31	29	31	29	30	30	33	27	
								60		60		60		60		

Number of credits for the entire period of study

Cycle code	Cycles of disciplines	Credits			
		required component (RC)	university component (UC)	component of choice (CCH)	Total
GED	Cycle of general education disciplines	51		5	56
BD	Cycle of basic disciplines		82	30	176
PD	Cycle of profile disciplines		24	40	
	Total for theoretical training:	*51*	*106*	*75*	*232*
FA	Final attestation	8			8
	TOTAL:	59	106	75	240

Decision of the Academic Council of Kaznrtu named after K.Satpayev. Protocol № 12 " 28 04 2022

Decision of the Educational and Methodological Council of Kaznrtu named after K.Satpayev. Protocol № 6 " 19 04 2022

Decision of the Academic Council of the Institute GiNGD . Protocol № 12 08 04 2022

Vice-Rector for Academic Affairs — R.K Uskenbaeva

GandOGB Institute Director — A.H. Syzdykov

Department Head Geophysics and seismology — B.T. Ratov

Specialty Council representative from employers — D.M. Khitrov