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

EDUCATIONAL PROGRAM
6B07201 Oil and gas and ore geophysics

Code and classification of the field of education: 6B07 - Engineering, processing and construction fields

Code and classification of training areas: 6B072 - Manufacturing and processing industries

Group of educational programs: B071 - Mining and mining

The level of the NRK: 6

The level of the ORC Level: 6

Duration of study: 4 years

Volume of credits: 240

Almaty 2022

The educational program 6B07201 - Oil and gas and ore geophysics was approved at the meeting of the Scientific Council of KazNRT named after K.I.Satpayev.

Protocol № 4 from «18»_ 12_ 2019y.

Reviewed and recommended for approval at a meeting of the Educational and Methodological Council of KazNRT named after K.I.Satpayev.

Protocol № 4 from «14» January 2020y.

Educational program 6B07201 – "Oil and gas and ore geophysics"

developed by the academic committee in the direction 6B072 Manufacturing and processing industries

Full name	**Academic degree/ academic title**	**Post**	**Place of work**	**Signature**
Chairman of the Academic Committee:				
Iskakov R.M.	Professor/PhD	Vice-Rector for Academic Work	JSC KazNRT named after K.I.Satpayev	
Teaching staff:				
Abetov A.E.	Doctor of Geological Sciences, Professor	Head of the Department of "Geophysics"	JSC KazNRT named after K.I.Satpayev	
Umirova G.K.	Doctor Ph.D	Ассоц.профессор	JSC KazNRT named after K.I.Satpayev	
Employers:				
Kovrizhnykh P.N.	Candidate of Geological Sciences, Laureate of the State Prize of the Republic of Kazakhstan in the field of science and technology named after Al-Farabi	1 Deputy. General Director	SPC "GEOKEN" LLP	
D. Khitrov	c.t.s.	Manager of the company's data processing center	«PGS Kazakhstan LLP»	
A.Zh.Akhmetzhanov	к.г-м. Sciences	Chief Geologist	KNOC	
Students				

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List of abbreviations and designations

EP – educational program;
HEI – higher education institution;
SMST – state mandatory standards of education;
ICT – information and communication technologies;
KazNTRU – Kazakh National Research Technical University;
MES RK – Ministry of Education and Science of the Republic of Kazakhstan;
NQF – National Qualifications Framework;
U – universal, social and ethical competencies
OQF – Industry Qualifications Framework;
PC – professional competencies;
RAS RF– Republican Academy of Sciences of the Russian Federation;
LO – learning outcomes of the educational program;
S – special and managerial competencies.
JSC – joint stock company;
LLP - limited liability partnership.

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" and is focused on the acquisition by students of basic theoretical knowledge and practical skills in the field of fundamental research of the Earth's crust, methodologies and methods of conducting, processing and interpreting the data obtained, hardware support for ground and borehole geophysical research in the search for and exploration of mineral deposits.

The Bachelor's degree program in preparation for the direction 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 high-quality knowledge by students 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.

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.

3rd-year bachelors studying in the oil and gas industry and having high academic performance can study under the additional Minor educational program. This is a set of disciplines and (or) modules and other types of educational work determined by the student for study (Rules for organizing the educational process on credit technology of education Order of the Ministry of Education and Science of the Republic of Kazakhstan dated 12.10.2018 No. 563) in order to obtain professional competencies determined directly by the Customer (Kazmunaygas).

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

Production practice is carried out in scientific research institutes (Institute of Seismology of the Republic of Kazakhstan, Institute of geological sciences. K. I. Satpayeva, Kaznipimunaygas, operator and service companies Karachaganak Petroleum Operating, Tengizchevroil, Kazgeologiya, PGD SERVICES, PGS, NPC Geoken LLP, Geo Energi Group, Tatarka, Kazakstankaspiishelf Kazakh Geophysical Company, Batys geophyservice, "GIS company", "Azimut Energy Service", "Kazakhmys", "Kazzinc", Eurasian Industrial Association, "Kazphosphor"," Maikayyn-gold"," Kazatomprom"," ZHAYREM Gok"," Asemtas"," Izleis"," GEOINT Center "LLP" Alstron"," Azimut geology"," anega Kazakhstan "LLP, JSC "Volgovgeologiya"-"Geotechnocenter",LLP "GISS",LLP "DP Ortalygy", LLP "Zhanros drilling", LLP "Izdenis", LLP "Karakudukmunay", JSC" Karazhanbasmunay", LLP" Kazgiiz", LLP" Kazakhoil Aktyube", LLP"

Kyzylkum", JSC" oil company Kor", JSC" UZENPROMGEOPHYSICS", LLP SP"Katko "JSC" KazMunayGas", JSC" PETROKAZAKHSTAN", LLP" BAPYMINING", JSC" Nak Kazatomprom", Kaz mineralspls", JSC "gmk KAZAKHALTYN", LLP "GEOENERGYGROUP" 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 the field of training "Oil and gas and ore geophysics" in accordance with the received professional training can perform the following activities:

Organizational and managerial:

- planning and organization of geophysical works on licensed blocks and areas;
- 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.

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

EP goals:

The Department of Geophysics conducts educational activities in the areas of bachelor's degree 6B07201 – "Oil and gas and ore geophysics".

The Department of Geophysics implements the preparation of bachelors of geophysicists of a wide profile for professional activity in the following theoretical and applied areas:

- prospecting and exploration of mineral deposits;
- fundamental research of the Earth's lithosphere;
- in-depth study of the theoretical foundations of geophysical methods;
- study of the principles of obtaining and processing field geophysical data, their geological interpretation and modeling;
- integration of geophysical methods in solving geological and geophysical problems.

The goals and objectives of this educational program are formulated taking into account the requirements and requests of potential consumers, and based on the assessment of the demand for 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 general objectives of the educational program are given in Table 1.

Table 1. The objectives of the educational program fully correspond to the strategic goal of the University and ensure the implementation of the mission of the University

The objectives of EP 6B07201 are "Oil and gas and ore geophysics". Goal code	**Formulation of goals**
01	Training of specialists in oil and gas and ore geophysics with an international level of competence capable of solving complex problems of prospecting and development of mineral deposits based on innovative methods and technologies of geophysical research (including modern equipment and software), using advanced means of registering geophysical potential fields.
02	Preparation of graduates for organizational activities that exclude negative phenomena in professional activity, the development of spiritual values, moral and ethical norms of the individual as a member of society, the implementation of the legal and legislative system of the Republic of Kazakhstan with a high level of professional culture, citizenship.
03	Preparing graduates for continuous self-improvement and self-development, mastering new knowledge, skills and abilities in innovative areas of oil and gas and ore geophysics.

04	Preparation of a graduate with acquired competencies to perform geophysical design work, design technical solutions, participate in the development of technical tasks for conducting geological and geophysical research based on modern educational material and technical base.
05	Preparation of a graduate competent in production and management, design, organizational, technological, scientific and pedagogical fields on the basis of modern training tools of information technology and information resources.
06	Preparation of a graduate, based on the diversity and dynamism of the catalog of elective disciplines of the curriculum, with a predominance of practical skills in competencies, capable of performing professional functions within one or more types of activities based on the final results of training, taking into account the specifics of these types of activities, market requirements for organizational, managerial, professional competencies.
07	Preparation of a graduate as a competitive specialist in the field of oil and gas and ore geophysics, including on the basis of increasing the international aspect in educational and scientific programs, competent in the field of advanced technologies in geophysical methods of prospecting and exploration of mineral deposits, execution and registration of the results of design and scientific research.

EP tasks:

- 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.

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

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

A graduate of the Department of Geophysics in the bachelor's degree program 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 degree program (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 "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

Table 2 - Passport of the educational program

№	Field name	Note
1	Code and classification of the field of education	6B07 Engineering, processing and construction fields
2	Code and classification of training areas	6B072 Manufacturing and processing industries
3	Group of educational programs	B071 Mining and mining
4	Name of the educational program	6B07201 Oil and gas and ore geophysics
5	Brief description of the educational program	It is intended for the implementation of specialized training of bachelors in the educational program of the specialty "Oil and gas and ore geophysics" Satbayev University. The Bachelor's degree program in the direction of "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	EP goals	1. Training of specialists in oil and gas and ore geophysics with an international level of competence capable of solving complex problems of prospecting and development of mineral deposits based on innovative methods and technologies of geophysical research (including modern equipment and software), using advanced means of registering geophysical potential fields. 2. Preparation of a graduate with acquired competencies to perform geophysical design work, design technical solutions, participate in the development of technical tasks for conducting geological and geophysical research based on modern educational material and technical base. 3. Preparation of a graduate competent in the field of advanced technologies in geophysical methods of prospecting and exploration of mineral deposits, execution and registration of the results of design and scientific research. 4. Training of a graduate competent in production and management, design, organizational and technological, scientific and pedagogical fields on the basis of modern training tools of information technologies and information resources. 5. Preparing graduates for continuous self-improvement and self-development, mastering new knowledge, skills and abilities in innovative areas of oil and gas and ore geophysics.
7	Type of EP	New
8	The level of the NQF	6
9	OQF Level	6
10	Distinctive features of the 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:** LO1: to use the physical foundations of geophysical methods and mathematical algorithms for analysis, modeling of hydrocarbon and TPI deposits when performing scientific and applied research in professional activities;

	LO2: to formulate an individual opinion on solving problems of geophysics, taking into account the latest domestic and foreign experience, based on an understanding of the main directions of development of the geophysical industry; LO3: demonstrate knowledge of modern geophysical field and laboratory equipment and geological and technological capabilities of industry software and methodological complexes, determine the technical parameters of the equipment and prepare it for field work (setup, verification or testing); LO4: demonstrate skills of independent formulation and solution of geophysical problems; generalization of a priori information for calculating the parameters of observation systems in land, sea, aero- and borehole variants for the preparation of project documentation for conducting geophysical observations based on business planning, anti-corruption policy and environmental and labor safety of life; LO5: demonstrate skills in managing research and production works using modern equipment, instruments, software and information technologies based on the principles of entrepreneurship and leadership, anti-corruption policy and life safety; LO6: demonstrate skills in working with computer software packages designed for the creative use of modern methods of analysis, processing, interpretation, modeling, graph and cartography of data from terrestrial, marine, aero- and borehole geophysics to solve scientific and practical problems; LO7: critically analyze the results of processing, interpretation and modeling of measurements based on basic research methods and systematic logical thinking, visualize the results based on comparison with complex data and develop conclusions, scientific conclusions to identify geological features of the results of work; LO8: synthesize a priori information from published and stock data, interpret, model, systematize, structure and format information in a form accessible to others, apply reliable interpretation techniques for linking and complex geological interpretation of borehole, drilling, geophysical and petrophysical data; compile and format results in the form of geological reports; LO9: to synthesize own ideas, results of scientific research and applied works in national or foreign publications in order to develop or form an independent view of the nature and structure of objects of work on hydrocarbon accumulations and TPI deposits, taking into account the main directions of geophysics development, integration of geophysical information and geological and field data; UP TO 10: defend and prove your own assessment of the latest domestic or foreign experience in forming an original judgment on a professional problem and conducting ethical interpersonal communication with public speaking skills and the ability to work in a team.	
13	Form of training	full - time
14	Duration of training	4
15	Volume of loans	240
16	Languages of instruction	Russian/Kazakh
17	Academic degree awarded	bachelor
18	Developer(s) and authors:	Professor A.E. Gabitov, assoc.professor Umirova G.K.

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

Table 3 - Results of training in the educational program "Oil and gas and ore geophysics"

№	Name of the discipline	Brief description of the discipline	Number of credits	Generated learning outcomes (codes)									
				PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
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	1/0/2				✓					✓	✓
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.	1/0/2				✓					✓	✓
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	0/0/6				✓					✓	✓

		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.											
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.	0/0/6				✓					✓	✓
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	2/1/0				✓					✓	✓
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	1/0/1				✓					✓	✓
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	2/0/1				✓					✓	✓

		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											
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.	0/0/8				✓						✓
Cycle of general education disciplines University component													
9	Fundamentals of anti-corruption culture	The discipline studies the essence, causes, causes of sustainable development of corruption from both historical and modern points of view. Examines the prerequisites and impacts for the development of an anti-corruption culture. Studies the development of anti-corruption on the basis of social, economic, legal, cultural, moral and ethical norms. Studies the problems of the formation of an anti-corruption culture based on the relationship with various types of social relations and various manifestations.	2/0/1					✓					✓
10	Fundamentals of Entrepreneurship and Leadership	The discipline studies the basics of entrepreneurship and leadership from the point of view of science and law; features, problematic aspects and prospects of development; theory and practice of entrepreneurship as a system of economic, organizational and legal relations of business structures; readiness of entrepreneurs for innovative receptivity. The discipline reveals the content of entrepreneurial activity, career stages, qualities, competencies and responsibilities of an entrepreneur, theoretical and practical business planning and economic expertise of business ideas, as well as risk analysis of innovative development,	2/0/1	✓	✓		✓	✓				✓	✓

		introduction of new technologies and technological solutions.											
11	Ecology and life safety	The discipline studies the problems of ecology as a science, environmental terms, the laws of the functioning of natural systems and aspects of environmental safety in working conditions. Environmental monitoring 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	2/0/1	✓			✓	✓					✓
Cycle of basic disciplines University component													
12	Mathematics I	The course is based on the study of mathematical analysis in a volume that allows you to explore elementary functions and solve the simplest geometric, physical and other applied problems. The main focus is on differential and integral calculus. The sections of the course include differential calculus of functions of one variable, derivative and differentials, the study of the behavior of functions, complex numbers, polynomials. Indefinite integrals, their properties and methods of calculation. Definite integrals and their applications. Improper integrals.	1/0/2	✓									✓
13	Physics I	The course studies the basic physical phenomena and laws of classical and modern physics; methods of physical research; the influence of physics as a science on the development of technology; the relationship of physics with other sciences and its role in solving scientific and technical problems of the specialty. The course covers the following sections: mechanics, dynamics of rotational motion of a solid, mechanical harmonic waves, fundamentals of molecular kinetic theory and thermodynamics, transport phenomena, continuum mechanics, electrostatics, direct current, magnetic field, Maxwell equations.	1/1/1	✓									✓
14	Physics II	The course studies the laws of physics and their practical application in professional activity.	1/1/1*	✓									✓

		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 the physical state 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.											
15	Mathematics II	The discipline is a continuation of Mathematics 1. The course sections include elements of linear algebra and analytical geometry. The main issues of linear algebra are considered: linear and self-adjoint operators, quadratic forms, linear programming. Differential calculus of a function of several variables and its applications. Multiple integrals. The theory of determinants and matrices, linear systems of equations, as well as elements of vector algebra. The elements of analytical geometry on the plane and in space are included.	1/0/2	✓									✓
16	Mathematics III	Mathematics 2. The sections of the course include: the theory of numerical series; the theory of functional series; Fourier series; elements of probability theory and mathematical statistics. Special attention is paid to solving problems in all sections of series theory; finding the probability of events; calculating the numerical characteristics of random variables; using statistical methods for processing experimental data.	1/0/2	✓									✓
17	Engineering and computer graphics	The course develops the following skills for students: to depict all possible combinations of geometric shapes on a plane, to carry out research and their measurements, allowing for image transformations; to create technical drawings, which are the main and reliable means of information that provides communication between the designer and the designer, technologist, builder, in the AutoCAD environment.					✓	✓					✓
18	General and structural	The discipline examines the issues of the material	2/1/0*		✓			✓					✓

	geology	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 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.											
19	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	2/2/0*		✓			✓					✓
20	Exploration geophysics	The discipline studies the internal structure of the Earth to search for and detail the structure of mineral deposits, as well as the 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.	2/1/0*	✓	✓	✓	✓	✓	✓				✓
21	Geology of oil and gas	The course studies the origin, conditions of occurrence and geological history of combustible minerals. Provides knowledge about reservoir rocks and tires, natural reservoirs for oil, gas and	2/1/0*	✓									✓

		water, traps, deposits and deposits of oil and gas. The conditions of oil and gas formation and oil and gas accumulation, migration, concentration and conservation of hydrocarbons in traps, as well as geological and geophysical methods of oil and gas prospecting are considered. On this basis, a scientific base for the search, exploration and development of oil and gas accumulations is being developed.											
22	Field theory	The course studies the basic laws of propagation of electromagnetic, thermal, radiation and acoustic fields in various media and their mathematical description. The basic concepts of field theory are considered, the theoretical foundations of gravitational, electric, electromagnetic fields, as well as elastic stresses and deformations in a solid are studied. The sections of the discipline are devoted to the main processes of propagation of fields in the medium and their interaction with matter, as well as a mathematical description of these processes.	2/1/0*	✓	✓								✓
23	Geophysical studies of wells 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.	2/1/0*	✓	✓	✓	✓	✓	✓		✓		✓
24	Methods of electrical exploration on direct 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.	2/1/0*	✓	✓	✓	✓	✓	✓				✓

		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.											
25	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.	2/1/0*	✓	✓	✓						✓	✓
26	Theoretical foundations of geophysical data processing	The basics of measuring geophysical data, equipment and geophysical information of digital format characterizing 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.	2/1/0*	✓	✓				✓				✓
27	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	2/1/0*	✓				✓	✓	✓	✓	✓	✓

		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											
28	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	✓	✓	✓	✓	✓	✓				✓
Cycle of basic disciplines Component of choice													
29	Fundamentals of Earth Physics	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 as a theoretical basis for the interpretation of geophysics data. The general idea of the internal structure of the Earth, the concepts of the origin and structure of the shells of the Earth, the physical properties of rocks, the theory of the origin of gravitational, electromagnetic, thermal and radioactive fields of the Earth and their structure are considered. The course studies seismicity, the causes of earthquakes, the dangers associated with them and the possibilities of seismic earthquake prediction.	2/1/0	✓	✓								✓
30	Physics of the Earth	The course is aimed at acquiring competencies for solving applied geological problems of studying the geological structure of the Earth's crust, rocks and the genesis of deposits, as well as forecasting, prospecting and exploration of mineral deposits. Examines the physical basis of the emergence of the gravitational, electromagnetic, thermal and radioactive fields of the Earth. Studies aspects of the applied use of analysis of the distribution of	2/1/0	✓	✓	✓	✓	✓	✓			✓	✓

		geophysical fields in space, methods for calculating geophysical parameters and identifying the causes of changes in fields for solving applied problems, including in the reconstruction of conditions for the formation of various mineral deposits.											
31	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	2/1/0	✓	✓				✓				✓
32	Geoinformation systems	The course studies the theory and practice of using geoinformation systems (GIS) to support and support and research in the field of Earth sciences. The discipline sections include the following issues: fundamentals of geoinformatics, methods and technologies for storing and processing information using computer technology, the use of geoinformation methods and technologies, databases for research in oil and gas and ore geophysics; methods of work in modern instrumental GIS; preparation for production work with instrumental GIS.	2/1/0	✓	✓				✓				✓
33	Theoretical foundations of gravity exploration	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	2/1/0	✓	✓	✓	✓	✓	✓			✓	✓

		fields that are excited by geological bodies.											
34	Methods of studying the Earth's 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 in the study of the shape of the Earth, the search for mineral deposits, the identification of deep faults and global tectonic structures.	2/1/0	✓	✓	✓	✓	✓	✓			✓	✓
35	Fundamentals of nuclear geophysics	The course introduces bachelors with a brief theory of nuclear geophysics and radiometry. The physical foundations of nuclear geophysics methods, their possibilities and limitations are considered. The acquisition of competencies in working with nuclear geophysical equipment and methods of radiometry on the ground, in the air and in the well will be obtained through the study of radiometric equipment, methods of nuclear geophysics and radiometry and methods of field work with the processing and interpretation of measurement results.	2/1/0	✓	✓	✓	✓	✓			✓	✓	✓
36	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.	2/1/0	✓	✓	✓	✓	✓			✓	✓	✓
37	Theoretical foundations, registration and processing	The course studies the fundamental physical and geological foundations of seismic exploration, the	2/1/0	✓	✓	✓	✓	✓	✓	✓			✓

	of seismic data	principles of operation of seismic equipment, methods and technologies used, procedures and algorithms for computer processing of seismic data. The dynamic theory of elasticity is studied; kinematics and dynamics of elastic waves in layered media, principles of geometric seismic exploration (principles of Huygens, Fresnel, Fermat and superposition), types, techniques and equipment of field seismic exploration, principles of obtaining seismic information, including the design of seismic observation systems; procedures for graph processing of seismic data.											
38	Seismic survey 1 (field seismic survey and processing of the received data)	The course examines the applied aspects of the theory of elastic vibration propagation and seismic wave processing, seismic survey equipment, vibration sources and field observation systems. The course is focused on methods and modifications of seismic exploration, practical tasks to be solved on the use of interference systems in seismic exploration, analog and digital systems for recording vibrations. The applied aspects of the technologies of seismic exploration MOGT-2D, 3D, 4D, GSZ, MPV, VSP, seismic logging are considered; digital registration of seismic signals and telemetric seismic recording systems, design of monitoring systems, processing graph.	2/1/0	✓	✓	✓	✓	✓	✓	✓			✓
39	Magnetic exploration 1 (physical and geological fundamentals of magnetic exploration)	The course studies the theoretical foundations of magnetic exploration, the structure and patterns 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: the physical and theoretical foundations of the magnetometric method, the principles of measuring magnetic field elements and the theory of magnetic exploration equipment, mathematical support for existing methods of preparing information for processing magnetometric data. The experience of using magnetic exploration in solving prospecting (hydrocarbons, ores) and mapping tasks is	2/1/0	✓	✓	✓	✓	✓	✓				✓

		considered.											
40	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.	2/1/0	✓	✓				✓	✓	✓	✓	✓
Cycle of profile disciplines University component													
41	Methods of interpretation of gravitational anomalies and estimation of object parameters	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.	2/1/0*	✓				✓	✓	✓	✓	✓	✓
42	Theoretical foundations of prospecting 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.	2/0/1*	✓	✓	✓	✓	✓	✓				✓

43	Methods of interpretation of electromagnetic fields and application of electrical exploration in solving geological and geophysical problems	Basic ideas of processing and interpretation of electrical 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 of electrical data. Acquisition of knowledge about the physical foundations of electrical exploration, technology for measuring elements of the electromagnetic field of artificial and natural nature, acquisition of skills in geophysical and geological interpretation of electrical data.	2/1/0*	✓					✓	✓	✓	✓	✓
44	GIS 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 GIS 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.	2/0/2*	✓	✓	✓	✓	✓	✓				✓
45	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	✓	✓	✓	✓	✓	✓				✓
46	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	3	✓	✓	✓	✓				✓	✓	✓

		experience in organizational, social, educational and professional work.											
Cycle of profile disciplines Component of choice													
47	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	2/1/0	✓	✓	✓	✓	✓			✓	✓	✓
48	Technogenic geophysics	Study of factors and patterns of formation of dangerous natural and man-made processes and phenomena; the influence of processes on the state of the environment. The 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.	2/1/0	✓	✓	✓	✓	✓			✓	✓	✓
49	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 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	2/1/0	✓	✓								✓

		hazard and prediction of earthquake consequences. Earthquake forecast											
50	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	2/0/1	✓	✓			✓	✓				✓
51	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; seismic and acoustic informativeness of GIS data and geological and technological capabilities of modern software and methodological complexes for the presentation of seismic information, joint visualization and interpretation of GIS and seismic materials. The issues of seismic imaging of geological environments, construction of reflecting and refractive boundaries by hodographs, time sections and cubes, seismic demolition, identification of tectonic disturbances, interruptions and inconsistencies; compilation of seismic maps; correlation of horizons on time sections are considered.	2/0/2	✓	✓			✓	✓	✓	✓	✓	✓
52	Seismic survey 2 (Interpretation of seismic data)	The course studies methods of mathematical interpretation of seismic data and the application of mathematical modeling of the acoustic field in order to solve geological problems. The physical foundations of procedures and algorithms for computer interpretation of seismic data are considered: stratigraphic binding, structural interpretation and resolution of seismic exploration; methods of attributive analysis, inversion and AVO/AVA analysis, quantitative	2/0/2	✓	✓			✓	✓	✓	✓	✓	✓

		prediction of FES using seismic data. The ways of maximum implementation of computerized systems, graphical modeling for the management of geological exploration technologies based on seismic data are being studied.											
53	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 processing and mathematical interpretation and modeling of geological and geophysical information at various stages of geological exploration.	2/1/0	✓	✓		✓	✓				✓	✓
54	Computer technologies in modeling of 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 various 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.	2/1/0	✓	✓				✓	✓	✓	✓	✓
55	Magnetic exploration 2 (processing and interpretation of magnetic exploration data)	The course is designed to study the issues of geological interpretation of magnetic exploration data. The sections of the discipline include: methods of interpretation of magnetic anomalies from complex bodies of finite dimensions; interpretation of magnetic anomalies based on	1/2/0	✓	✓				✓	✓	✓	✓	✓

		transformations and geological reductions; separation of fields from the positions of frequency filtering. The principles of joint analysis with geological and structural maps, geological sections constructed from drilling data, and laboratory data for determining magnetic susceptibility for various rocks are considered. A special place is given to solving direct and inverse problems of magnetic exploration, obtaining additional information about the geological nature of magnetic anomalies.											
56	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.	1/2/0	✓	✓				✓	✓	✓	✓	✓
57	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.	2/1/0	✓	✓				✓	✓	✓	✓	✓

58	An 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 considered.; construction of quantitative physico-geological models for solving geological mapping, prospecting, exploration, engineering and environmental problems.	2/1/0	✓	✓			✓	✓	✓	✓	✓	✓
59	Theoretical foundations and applied aspects of GIS	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.	2/1/0	✓	✓	✓	✓		✓				✓
60	GIS 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, 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 GIS complex 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.	2/1/0	✓	✓			✓	✓	✓	✓	✓	✓
61	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	2/0/2	✓	✓			✓	✓	✓	✓	✓	✓

		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										
62	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.	2/1/0	✓	✓			✓	✓	✓	✓	✓	✓

5. Curriculum of the educational program

K.I.SATPAYEV KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY

SATBAYEV UNIVERSITY

I APPROVE
Chairman of the Management Board- Rector of KazNRTU named after K.I.Satpayev
_____ M.M.Begentaev
«____» _____ 2022 y.

CURRICULUM
EDUCATIONAL PROGRAMS for recruitment for the 2022-2023 academic year
Educational program 6B07201 Oil and gas and ore geophysics
Group of educational programs B071 Mining and Mining

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 loans	Total hours	Classroom volume of lek/lab/pr	IWS (including IWSP) in hours	Form of control	Distribution of classroom classes by 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. Language training module															
LNG 108	Foreign language	GD, RK	10	300	0/0/6	210	E	5	5						
LNG 104	Kazakh (Russian) language	GD, RK	10	300	0/0/6	210	E	5	5						
M-2. Physical training module															
KFK 101-104	Physical Culture	GD, RK	8	240	0/0/8	120	Dif offset	2	2	2	2				
M-3. Information Technology Module															

CSE 677	Information and communication technologies (in English)	GD, RK	5	150	2/1/0	105	E			5					
M-4. Module of socio-cultural development															
HUM 100	Modern history of Kazakhstan	GD, RK	5	150	1/0/2	105	ГЕ	5							
HUM 132	Philosophy	GD, RK	5	150	1/0/2	105	E			5					
HUM 120	Module of socio-political knowledge (sociology, political science)	GD, RK	3	90	1/0/1	60	E			3					
HUM 134	Module of socio-political knowledge (cultural studies, psychology)		5	150	2/0/1	105	E				5				
M-5. Module fundamentals of anti-corruption culture, ecology and life safety															
HUM 133	Fundamentals of anti-corruption culture	GD, RK	5	150	2/0/1	105	E				5				
MNG 488	Fundamentals of Entrepreneurship and Leadership														
CHE 656	Ecology and life safety														
CYCLE OF BASIC DISCIPLINES (BD)															
M-6. Module of physical and mathematical training															
MAT 101	Mathematics I	BD, UK	5	150	1/0/2	105	E	5							
PHY 111	Physics I	BD, UK	5	150	1/1/1	105	E	5							
PHY112	Physics II	BD, UK	5	150	1/1/1*	105	E		5						

MAT 102	Mathematics II	BD, UK	5	150	1/0/2	105	E		5						
MAT 103	Mathematics III	BD, UK	5	150	1/0/2	105	E			5					
M-7. Basic training module															
GEN 429	Engineering and computer graphics	BD, UK	5	150	1/0/2	105	E		5						
M-8. Module of geological and geophysical disciplines															
GEO198	General and structural geology	BD, UK	4	120	2/1/0*	75	E	4							
GEO490	Mineralogy and petrography	BD, UK	6	180	2/2/0*	120	E			6					
GPH184	Exploration geophysics	BD, UK	5	150	2/1/0*	105	E				5				
2301	Elective	BD, CC	*5*	150	2/1/0*	105	*E*			5					
GEO486	Geology of oil and gas	BD, UK	5	150	2/1/0*	105	E				5				
GPH165	Field theory	BD, UK	5	150	2/1/0*	105	E					5			
2302	Elective	BD, CC	5	150	2/1/0*	105	E				5				
GPH180	Geophysical studies of wells of uranium deposits	BD, UK	5	150	2/1/0*	105	E					5			
GPH122	Methods of electrical exploration on direct and alternating electric current	BD, UK	5	150	2/1/0*	105	E					5			
GPH185	Petrophysics	BD, UK	5	150	2/1/0*	105	E					5			

GPH174	Theoretical foundations of geophysical data processing	BD, UK	5	150	2/1/0*	105	E					5			
3301	Elective	BD, CC	5	150	2/1/0*	105	E					5			
GPH182	Modern geophysical technologies for calculating reserves of uranium deposits	BD, UK	5	150	2/1/0*	105	E						5		
3302	Elective	BD, CC	4	120	2/1/0*	75	E						4		
3303	Elective	BD CC	5	150	2/1/0*	105	E						5		
4301	Elective	BD, CC	6	180	2/2/0*	120	E							6	
CIV784	Educational practice	BD, UK	2						2						
CYCLE OF PROFILE DISCIPLINES (PD)															
M-9. Module of geophysical disciplines															
GPH413	Methods of interpretation of gravitational anomalies and estimation of object parameters	PD, UK	4	120	2/1/0*	75	E						4		
GEO456	Theoretical foundations of prospecting and exploration of oil and gas fields	PD, UK	5	150	2/0/1*	105	E						5		

GPH414	Methods of interpretation of electromagnetic fields and application of electrical exploration in solving geological and geophysical problems	PD, UK	4	120	2/1/0*	75	E						4		
GPH417	Geophysical studies of wells in the search for hydrocarbon deposits	PD, UK	6	180	2/0/2*	120	E							6	
4302	Elective	PD, CC	5	150	2/1/0*	105	E							5	
4303	Elective	PD, CC	5	150	2/1/0*	105	E							5	
4304	Elective	PD, CC	6	180	2/0/2*	120	E							6	
4305	Elective	PD, CC	5	150	2/1/0*	105	E							5	
4306	Elective	PD, CC	5	150	1/2/0*	105									5
4307	Elective	PD, CC	5	150	2/1/0*	105	E								5
4308	Elective	PD, CC	5	150	2/1/0*	105	E								5
CIV785	Production practice I	PD, UK	2								2				
CIV786	Industrial practice II	PD, UK	3										3		
M-10. Module of final certification															

ECA003	Preparation and writing of a thesis (project)	FC	6												6
ECA103	Defense of the thesis (project)	FC	6												6
M-11. Module of additional types of training															
AAP500	Military training	ATO	0												
	Total by 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 (RK)	university component (UK)	component of choice (CC)	Total
ООД	Cycle of general education disciplines	51		5	56
БД	Cycle of basic disciplines		82	30	112
ПД	Cycle of profile disciplines		24	36	60
	Total for theoretical training:	*51*	*106*	*71*	*228*
ИА	Final certification	12			12
	TOTAL:	**63**	**106**	**71**	**240**

The decision of the Academic Council of KazNTU named after K.Satpayev.
Protocol No. 13 of "28" 04 2022y.

A school-methodical solution, they were punished. K.Satpayeva.
Protocol № 7th " 26 " 04 2022 y.

Decision of the Scientific Council of the Institute of Geology and Oil and Gas Business
Protocol No. 4 of "30" 12 2021 y.

Vice-Rector for Academic Affairs **B.A.Zhautikov**

Director of the Institute **A.H.Syzdykov**

Head of the Department **A.E.Abetov**

Representative of the Specialty Council from employers **D.M.Khitrov**

6. Additional educational program (Minor)

Training program (minor) of narrow specialists in the oil and gas industry for KMG Engineering LLP in the specialty: "Geophysical methods of prospecting and exploration of mineral deposits " (2019)

1. Petrophysics of carbonate reservoirs (place and role in geological research. Modern methods and tools for the study of core samples) - the main:

- The structure of the pore space of carbonate rocks and factors affecting the formation of effective pores.
- Characteristics of reservoir properties of rocks. Influence of reservoir conditions on physical and reservoir properties. Porosity and compressibility coefficients of pores
- Characteristics of various types of carbonate reservoirs (intergranular, fractured and cavernous types)
- Determination of reservoir properties and the nature of saturation of carbonate rocks with a complex structure of the pore space.
- Влияние процессов диффузии и фильтрации бурового раствора на удельное сопротивление трещинно-кавернозных пород
- The effect of oil saturation of blocks on the resistivity of fractured cavernous carbonate rock
- Total porosity (neutron gamma method, ultrasonic method, resistance method for determining intergranular porosity
- Method for determining intergranular porosity. Application of induction method for determination of intergranular porosity
- Fractured porosity. Assessment of the nature of saturation
  Study of productivity and oil content of rocks (forecasting the productivity coefficient of carbonate reservoirs, determination of specific oil content of rocks).

2. **Geological and technological control and geophysical research in the process of drilling in carbonate reservoirs - backup:**

- A set of geological and technological tasks aimed at the operational alloca tion of promising oil and gas reservoir formations in the context of a well under drilling, the study of their filtration-capacitance characteristics and t he nature of saturation, optimization of core sampling, express testing and study of selected objects by GIS methods, ensuring trouble-free wiring of wells and optimization of drilling mode in order to achieve technical ande conomic indicators of the drilling process.
- The main tasks of the GTI are Geological tasks: Optimization of obtaining geological and geophysical information (selection and adjustment of interv als for core sampling, sludge, soil samples; intervals and time of GIS; inter vals and time of testing and testing). Operative lithological dissection of th

e section. Operational allocation of reservoir layers. Determination of the n ature of saturation of reservoir layers. Determination of filtration-capacita nce properties (FES) of reservoir layers.

- Control of the testing process and determination of the hydrodynamic char acteristics of formations during testing and testing of objects. Determinati on of the productivity of the section. Forecasting of hydrocarbon deposits up to the moment of their discovery. Identification of geodynamic rappers. Selection of the method and method of secondary reservoir opening
- Technological tasks: optimization of the well deepening process dependin g on geological tasks. Recognition and determination of the duration of th e technological operation. Selection and maintenance of a rational drilling regime by the control of drill bits. Optimization of descent and lifting oper ations (limitation of descent speed, optimization of loading of lifting mech anisms). Control of the hydraulic system of the drilling rig during drilling.
- Control of the behavior of the well (inflow, absorption) during the descent and lifting operations, top-up management. Determination of reservoir an d pore pressures (prediction of AVPD and ANPD zones. Control and man agement of the descent and cementing of the casing. Determination of the strength and abrasive properties of rocks according to the section under st udy. Monitoring and control of the trajectory of an obliquely directed well . Automatic control of the well deepening process.
- Diagnostic tasks: Early detection of gas and oil occurrences and absorptio n during drilling. Determination of the degree of degassing of the pancrea s in the circular system in connection with the possibility of continuing dri lling during development. Diagnostics of pre-emergency situations in real time. Diagnostics of drilling equipment operation.

3. Seismic methods in the study of carbonate and terrigenous reservoirs. Processing and interpretation of seismic data on reflected waves is the main:

- Physico-geological foundations of seismic exploration on reflected waves in the study of carbonate reservoirs (elements of the classical theory of elastic waves in homogeneous and inhomogeneous media, ideal and real, isotropic and anisotropic, features of surface and linear hodographs of various waves).
- Solution of direct and inverse problems of seismic exploration, fundamental approaches to the structure of the processing process, its basic procedures, prerequisites and effectiveness of various types of frequency and space-time filtering,
- Features of summation of reflected waves, determination of velocities and construction of seismic images of geological objects by migration transformations.
- Methods of qualitative and quantitative interpretation of reflected wave recordings for the purpose of prospecting and exploration of oil and gas deposits in carbonate reservoirs.

- Kinematic interpretation (tracing and stratification of seismic boundaries, identification of discontinuous faults and fracture zones, detection of multiple reflections, compilation and analysis of seismic maps and diagrams. accuracy and resolution of seismic exploration).
- Dynamic interpretation (variations in the amplitudes of reflected waves for oil and gas reservoirs associated with a change in the distance from the source to the receiver, with an inclined drop of the boundaries, the possibility of amplitude analysis of the data of the SMT, qualitative and quantitative interpretation of amplitudes, surface, interval and volume attributes).

4. Integration of seismic exploration and logging methods in the exploration of oil and gas fields in carbonate reservoirs is the main:

- Introduction. The subject, goals and objectives of the integration of seismic exploration and logging. The role of these disciplines in the exploration process. Advantages and disadvantages of seismic exploration and logging methods.
  Principles of aggregation. A rational complex of seismic exploration and logging. Components and stages of integration. Factors determining the choice of a set of methods.
- Integration of seismic exploration and drilling in the search for oil and gas fields. Direct prospecting and exploration of oil and gas fields in carbonate reservoirs.
- Types of traps. Reservoir properties of oil and gas bearing formations. Their significance in determining the reserves of the deposit (deposits). Anticline, non-anticline traps. Seismic facies complexes. Seismophations. Parameters of the seismic record, and their geological interpretation. Capacitive and filtration properties of collectors.
- Wave field analysis for geological section forecasting (wave field analysis as a means of studying sedimentary strata; reflection amplitudes; phase parameters and frequency of reflections; reflection coherence coefficient; estimates of signal compression; absorption and velocity).
- Causes of distortion of dynamic parameters of reflections during registration and processing of seismic signals. Software tools for quantifying dynamic parameters of reflections and instantaneous velocities
- Practical use of dynamic parameters of seismic waves for prospecting and exploration of hydrocarbon deposits
- Study of the detailed structure of carbonate sections by seismic exploration and drilling
  (acoustic and density properties of carbonate rocks, inversion of seismic recording into a pseudoacoustic section, application of pseudoacoustic transformation of seismic data to solve problems of oil and gas exploration geology).

5. Introduction to Seismic Stratigraphy - Backup:

- Types of seismophations and seismic complexes. Disagreements, their characteristics and main types. Sedimentary cycles and cyclites. The concept of the transgressive-regressive regime of cyclogenesis.
- Basic techniques for reconstructing the history of sedimentary basins and estimating sea level fluctuations from seismostratigraphic data.
- Geological boundaries, geological bodies, global and regional cycles of sea level change.
- Geological problems solved in the analysis of structural and formation complexes. Clinoform, fondaform and undaform zones of accumulation of sedimentary rock complexes.
- Tracts of systems of low and lowering levels, high sea level and transgressive systems conditions for the formation of sedimentary systems. The nature of the manifestation in wave fields and the features of their geological interpretation.
- The relationship between physical boundaries and seismic reflections. The form of contacts of seismic boundaries and associated seismic horizons.
- Interpretation of logging data from the perspective of sequential stratigraphy. The severity of the paths of sedimentary systems on logging diagrams.
- Computer simulation of seismophations. Interpretation graphs. Examples of extraction of seismophations.
- The possibilities of volumetric seismic exploration when mapping complex hydrocarbon deposits.
  Geological interpretation of seismic facies. Basic concepts and directions of seismostratigraphic interpretation.

Table 5 – Information on the additional educational program (Minor) with disciplines (2019)

Name of additional educational programs (Minor) with disciplines	Total number of credits	Recommended semesters of study	Documents on the results of the development of additional educational programs (Minor)
The program of training (minor) of narrow specialists in the oil and gas industry for KMG Engineering LLP in the specialty: "Geophysical methods of prospecting and exploration of mineral deposits" (2019). Name of the main disciplines: 1. Petrophysics of carbonate reservoirs (place and role in geological research. Modern methods and tools for the study of core samples) 2. Seismic methods in the study of carbonate and terrigenous reservoirs. Processing and interpretation of seismic data on reflected waves 3. Integration of seismic exploration and logging methods in the exploration of oil and gas fields	15	5, 6 and 7	

in carbonate reservoirs. Name of reserve disciplines: 4. Geological and technological control and geophysical studies during drilling in carbonate reservoirs. 5. Introduction to seismic stratigraphy.			