



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

EDUCATIONAL PROGRAM

6B07223 - “Drilling of wells for solid minerals and water”

Code and classification of the field of education: 6B07 "Engineering, manufacturing and construction industries"

Code and classification of training areas: 6B072 «Industrial and manufacturing branches»

Group of educational programs: B071 Mining and mineral extraction

NRK Level: 6

ORC Level: 6

Duration of training: 4

Volume of credits: 240

Almaty, 2025

The educational program 6B07223 - “Drilling of wells for solid minerals and water” was approved at the meeting of the Scientific Council of KazNITU named after K.I.Satpayev.

Protocol №17 from «18» 06. 2025 y.

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

Protocol №7 from «10» 06. 2025 y.

The educational program 6B07223 - “Drilling of wells for solid minerals and water” was developed by the academic committee in the direction of 6B072 «Industrial and manufacturing branches»

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List of abbreviations and designations

NAO "Kazakh National Research Technical University named after K.I.Satpayev" - NAO KazNRTU named after K.I.Satpayev;

GOSO – The State mandatory standard of education of the Republic of Kazakhstan;

MNiVO – Ministry of Science and Higher Education;

OP – educational program;

University – higher education institution;

NRK – National Qualifications Framework;

Research and development–scientific and research work;

OK – general cultural competencies;

Defense industry – General professional competencies;

ORC – Industry Qualifications Framework;

PC – professional competencies;

Teaching staff – teaching staff;

RO – learning outcomes of the educational program;

JSC – joint stock company;

LLP – limited liability company;

SRO (SRS, SRM, SRD) – independent work of the student;

SRDP (SRSP, SRMP, SRDP) – independent work of a student with a teacher;

RUP – working curriculum;

IEP is an individual curriculum.

1. Description of the educational program

The Bachelor's Degree Program 6B07223 - "Drilling of wells for solid minerals and water" is developed within the framework of the B071 - Mining and mineral extraction training direction and is aimed at equipping students with fundamental knowledge and practical skills in the field of geological exploration, methods, and technologies for prospecting, evaluating, and developing deposits of solid, liquid, and gaseous minerals, as well as underground water.

The program covers the study of modern geophysical, geochemical, and hydrogeological methods used at various stages of exploration, as well as mastering drilling technologies, sampling, and data analysis. Special attention is given to environmental protection and rational use of natural resources during exploration activities.

Graduates of the program will acquire competencies for conducting geological research, analyzing geological and hydrogeological data, designing and implementing exploration projects, and assessing the economic feasibility of deposit development.

The Bachelor's Program 6B07223 - "Drilling of wells for solid minerals and water" ensures:

a) Training of specialists in geological exploration, prospecting, evaluation, and development of mineral and underground water deposits.

b) Acquisition of fundamental knowledge about the geological structure of the Earth, patterns of mineral deposit formation and distribution, as well as hydrogeological conditions necessary for underground water exploration and evaluation.

c) Familiarization with modern exploration methods and technologies, including geophysical, geochemical, hydrogeological, and drilling techniques, as well as principles of geological modeling and mineral resource estimation.

d) Development of skills in drilling and well sampling technologies, sample analysis methods, data interpretation, and principles of exploration project organization and execution at different stages.

e) Knowledge of modern equipment and software used for geological and hydrogeological research, as well as for data processing and analysis.

f) Acquisition of skills in geological and hydrogeological data analysis, interpretation of exploration results, and preparation of geological reports, maps, and plans.

The Bachelor's Program 6B07223 - "Drilling of wells for solid minerals and water" is designed to train specialists with professional skills and competencies required for a successful career in various sectors related to exploration and development of natural resources. Graduates of the program will be able to:

Work in geological and mining companies: Plan and conduct geological exploration activities, supervise drilling and sampling processes, analyze geological and hydrogeological data, participate in mineral resource estimation, and ensure compliance with environmental regulations during deposit development.

- **Work in research institutions:** Conduct scientific research in geology, geophysics, and hydrogeology; develop new methods and technologies for deposit exploration; and participate in scientific projects focused on studying the geological structure and Earth's subsurface resources.
- **Work in government organizations:** Manage and monitor the use of natural resources, develop regulatory frameworks in geology and mining, and ensure the rational and sustainable use of natural resources in compliance with environmental standards and regulations.

Additionally, the program aims to develop the following professional qualities in students:

- **Analytical skills:** Ability to analyze geological, geophysical, and hydrogeological data, make well-founded conclusions, and make decisions based on the obtained information.
- **Technical skills:** Proficiency in modern geological exploration methods and technologies, as well as the ability to work with geodetic and mining-geological equipment and software.
- **Communication skills:** Ability to collaborate effectively with other specialists and present research findings and project results through reports and presentations.
- **Responsibility:** Understanding the importance of complying with environmental standards and regulations for environmental protection during exploration activities.

Thus, the 6B07223 - “Drilling of wells for solid minerals and water” program provides graduates with comprehensive training essential for a successful professional career and further development in the fields of geology and mining.

For lectures and consultations on modern drilling challenges, professors from leading international universities, as well as experts from industrial companies and research institutes, are invited.

Students undergo field training at the "Burovik" training site in Kapshagay, gaining hands-on experience in geological exploration techniques.

The industrial internship under the 6B07223 - “Drilling of wells for solid minerals and water” program is conducted in various organizations engaged in geological exploration, mineral extraction, research, and government institutions specializing in subsurface studies and natural resource management.

Organizations offering internship opportunities include: LLP "Kazgeology", JSC "National Geological Exploration Company 'Kazgeoinzhiniring'", JSC "ArcelorMittal Temirtau", JSC "Kazakhmys", JSC "Eurasian Group", Ministry of Ecology, Geology, and Natural Resources of the Republic of Kazakhstan Committee of Geology and Subsoil Use under the Ministry of Ecology, Geology, and Natural Resources of Kazakhstan, RSE "Kazvodkhoz"

Other organizations engaged in drilling for geological exploration, oil and gas extraction, and other purposes.

As part of the industrial internship, students gain hands-on experience in drilling and well sampling, including: Participation in drilling operations, core and fluid sampling, conducting geophysical well investigations.

The industrial internship allows students to apply their acquired knowledge in practice, develop essential professional skills, and establish connections with

potential employers.

Top-performing students have the opportunity to pursue additional education through academic mobility programs at universities worldwide.

Graduates of the 6B07223 - “Drilling of wells for solid minerals and water” program receive the qualification of Bachelor of Natural Sciences and can hold various positions in organizations related to geology, mining, and natural resource management.

Possible workplaces and positions: geological technician, drilling and sampling specialist, geotechnical control specialist, environmental monitoring specialist, drilling technologist, drilling fluids specialist, drilling engineer.

Practical significance: The results of the work of specialists in the field of mineral exploration are used to supply the country's economy with essential mineral resources, as well as to provide the population with clean drinking water.

Professional development: Work in this field requires continuous professional growth and training in new methods and technologies for exploration and resource development.

Interesting and diverse work: The profession of an exploration geologist involves working both in the field and in the office, making it engaging and varied.

Opportunity to work in different regions: Specialists in the field of mineral exploration can work in various regions of the country and abroad, providing opportunities to travel and experience new cultures.

Career Growth Opportunities: Graduates of the program can advance in their careers from junior specialists to project and enterprise managers.

Opportunity to Work in International Companies: Specialists in mineral exploration are in demand in the international job market, and graduates of the program can work for major international companies engaged in exploration and extraction of mineral resources.

Participation in Innovative Projects: Specialists in mineral exploration can take part in the development and implementation of new innovative technologies, contributing to the advancement of the industry.

Thus, the profession of a specialist in mineral and water exploration is in high demand, interesting, and promising, offering graduates extensive opportunities for professional growth and self-fulfillment.

Field of Professional Activity:

The professional field of a bachelor's degree graduate in the program – 6B07223 - “Drilling of wells for solid minerals and water”

– encompasses a range of technologies, tools, methods, and techniques aimed at: studying the geological structure of the Earth's crust, searching for and exploring mineral deposits, evaluating mineral reserves, exploring and utilizing groundwater, drilling and well-testing technologies, laboratory research, and innovative developments.

The key role of specialists in this field includes ensuring the resource base, the rational use of natural resources, environmental safety, and the implementation of modern technologies.

Thus, the professional field of a bachelor's degree graduate in the program 6B07223 - “Drilling of wells for solid minerals and water” – is multifaceted and covers a wide range of tasks related to the study, exploration, evaluation, and utilization of the Earth's subsurface natural resources.

Objects of Professional Activity:

The professional field of a bachelor's degree graduate in the program 6B07223 - “Drilling of wells for solid minerals and water” includes the study and utilization of the following objects and processes: Geological structures and formations, Mineral deposits, Groundwater and natural resources, Processes of mineral deposit formation, Exploration methods, Drilling and well-testing technologies, Laboratory analysis methods, Mathematical and geological modeling, Geographic Information Systems (GIS), Mine workings, Physical fields in rock formations, Geophysical information-measuring and processing systems, Risk forecasting and management, Technogenic impacts.

Thus, the professional field of a bachelor's degree graduate in the program 6B07223 - “Drilling of wells for solid minerals and water” – encompasses a wide range of objects, processes, and technologies related to the study, exploration, evaluation, and utilization of the Earth's subsurface natural resources.

Subjects of Professional Activity:

The subjects of professional activity for a bachelor's degree graduate in the educational program 6B07223 - “Drilling of wells for solid minerals and water” – include the study of geological structures and processes, mastering modern drilling methods and technologies, as well as the development and exploitation of solid mineral and groundwater deposits. The training covers drilling technologies, engineering solutions for natural resource extraction, drilling operation management systems, environmental safety, and the economic aspects of the industry.

Thus, the educational program is designed to prepare specialists capable of efficiently conducting drilling operations, developing deposits, and managing their exploitation processes while adhering to environmental regulations and modern economic requirements.

The areas of professional activity of a bachelor are:

- Provision of drilling services: Work in service companies providing drilling services for various industries.
- Drilling equipment maintenance and repair: Work in companies specializing in drilling equipment maintenance and repair.
- Drilling equipment and materials sales: Work in companies that sell drilling equipment and materials.
- Exploration Drilling: Drilling operations to find and evaluate groundwater reserves.
- Drilling of production wells: Organizing and supervising the drilling of drinking and service water wells.

- Drilling of observation wells: Participate in the drilling of wells for monitoring groundwater levels and quality.
- Drilling of wells for engineering and geological surveys: Participation in drilling for the study of soils and geological conditions.

Types of professional activity:

Types of professional activities of a bachelor graduate are quite diverse and depend on his specialization, qualification and field of work. Here are the main types of professional activities that can be carried out:

1. technological activity:

- Well drilling: The main type of activity, including the direct performance of work on deepening the well, breaking rocks, lowering and lifting the drilling tools.
- Well anchoring: Performing well casing and cementing operations to ensure well stability and isolate formations.
- Well Flushing: Preparing, using, and controlling the parameters of drilling fluids to remove drilled rock, cool tools, and maintain specified pressures.
- Well Testing: Performing activities to sample formation fluids, determine flow rates and other well parameters.
- Accident elimination: Participation in measures to eliminate emergencies arising in the process of drilling (seizures, collapses, sinking, etc.).
- Drilling equipment maintenance and repair: Perform maintenance and repair of drilling rigs and equipment.
- Drilling parameters control: Control over compliance with technological drilling modes, measurement and analysis of well parameters.
- Documentation of drilling operations: Maintaining technical documentation on drilling progress, preparing reports and schedules.

2. organizational and management activities:

- Planning of drilling operations: Development of drilling plans-schedules, determination of necessary resources and timing of work.
- Organization of work at the drilling site: Ensuring efficient work of the drilling team, distribution of responsibilities and control over their implementation.
- Control over safety compliance: Ensuring compliance with labor protection and industrial safety requirements on the rig.
- Interaction with other divisions: Coordination of work with geologists, geophysicists, mechanics and other specialists.
- Drilling project management: Participation in drilling project management, control over fulfillment of targets and deadlines.

3. research and development activities:

- Development of new drilling technologies: Participation in scientific research aimed at improving drilling technology.
- Development and implementation of new drilling fluids: Participation in the development and testing of new drilling fluids and materials.

- Study of drilling impact on the environment: Study of drilling impact on the geological environment and development of measures to reduce the negative impact.
- Analysis and summarization of drilling results: Analysis of drilling data, development of recommendations for optimization of technological processes.

4. Control activities:

- Drilling quality control: Carrying out control over compliance with technological parameters of drilling and quality of work performed.
- Equipment condition control: Control over technical condition of drilling rigs and equipment.
- Technical supervision: Carrying out technical supervision of drilling operations.
- Audit of drilling operations: Participation in auditing drilling operations to assess their efficiency and safety.

5. Specialized activities:

- Drilling of directional and horizontal wells: Performing work on drilling wells with specified curvature.
- Offshore drilling: Participation in drilling wells in offshore conditions.
- Deep Well Drilling: Performing well drilling operations at great depths.
- Drilling with application of special technologies: Use of modern drilling technologies (hydraulic fracturing, drilling with borehole reaming, etc.).
- Working with geophysical instruments: Participation in geophysical well surveys.

These activities may be performed either on drilling sites or in offices, depending on the position and duties performed.

2. Purpose and objectives of the educational program

The chair “Petroleum Engineering” carries out educational activity in the direction of training on the bachelor's program trajectory 6B07223 - “Drilling of wells for solid minerals and water”

The department plans to prepare bachelors-drillers of a wide profile for professional activity in the following theoretical and applied directions:

- Well drilling technologies: Study of modern technologies of drilling wells for various purposes, including vertical, directional and horizontal drilling, as well as drilling in complicated conditions.
- Drilling equipment and tools: Learning the principles of operation and maintenance of drilling equipment and tools, including drilling rigs, drill pipes, bits, casing and auxiliary equipment.
- Drilling Muds and Flushing Fluids: Study of properties and application of different types of drilling fluids, as well as methods of controlling their parameters.
- Geological support of drilling: Understanding the geological structure of the subsurface, assessing geological risks and developing measures to minimize them.
- Hydrogeologic aspects of drilling: Studying the hydrogeologic conditions of the drilling area and methods to control water penetrations in wells.

- Wells anchoring: Mastering the methods of securing well walls with casing and cement slurries.
- Drilling complications and methods of their elimination: Studying the causes of drilling complications (snags, collapses, sinking) and methods of their elimination.
- Organization and management of drilling works: Mastering the methods of planning, organization and management of drilling works.
- Drilling Economics: Understand the economics of drilling and how to evaluate the efficiency of drilling operations.
- Drilling Health and Safety: Learn the health and safety requirements of drilling operations.
- Environmental Safety in Drilling: Understand the environmental impacts of drilling and how to minimize them.
- Mineral Exploration and Development: Explore methods of prospecting, exploration and development of oil, gas, water and solid mineral deposits.

The goals and objectives of the presented educational program are formulated taking into account the requirements and demands of potential consumers, as well as 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.

This program is aimed at training highly qualified specialists-drillers who are able to work effectively in various industries where well drilling is required and solve complex technical problems. Graduates of the program will possess both theoretical knowledge and practical skills necessary for a successful career in drilling.

OP Objective: To train highly qualified specialists with deep theoretical knowledge and practical skills necessary for design, management and leadership in the development of modern drilling technologies, methods of geological research and data analysis to develop strategies for the search for and evaluation of mineral deposits and groundwater based on the principles of labor safety, rational use of natural resources, compliance with environmental standards and support for sustainable development, taking into account inclusion and gender equality

OP Objectives:

General Objectives:

1. Training of highly qualified specialists: To provide training of competent and competitive specialists in the field of drilling with the necessary theoretical knowledge and practical skills to work in various industries.

2. Formation of professional competencies: To form the necessary professional competencies in students to enable them to effectively perform well drilling operations for various purposes.

3. Providing fundamental training: To provide students with fundamental knowledge in mathematics, physics, chemistry, geology and other related sciences necessary to understand drilling processes.

4. Developing Research Skills: To develop students' skills in conducting

scientific research, analyzing and interpreting data, and solving non-routine drilling problems.

5. Development of professional thinking: To develop students' professional thinking to enable them to make informed decisions in various drilling situations.

6. Education of responsibility: To educate students to be responsible for their work, as well as for compliance with the requirements of labor protection and industrial safety, as well as for environmental aspects of drilling.

7. Providing Continuous Professional Development: Prepare students for continuous professional development and advancement throughout their careers.

8. Adapting to modern technology: Ensure that students are familiar with modern technology and equipment used in the drilling field.

9. Meeting the needs of the labor market: To prepare specialists in demand in the labor market in various industries related to drilling.

Special Problems:

10. Study of drilling technologies: To give students in-depth knowledge of modern technologies of drilling wells for various purposes (vertical, directional, horizontal drilling, drilling in difficult conditions).

11. Study of drilling equipment: To teach students to understand the structure, principles of operation and methods of maintenance of drilling rigs and equipment.

12. Application of drilling fluids: To teach students the correct preparation, application and control of parameters of drilling fluids and flushing fluids.

13. Study of geology and hydrogeology: To provide knowledge in the geological structure of the subsoil, as well as in the hydrogeological conditions of the drilling area.

14. Drilling Safety: To teach students to observe safety and industrial safety requirements during drilling operations, as well as to apply methods of combating complications.

15. Well anchoring: To provide knowledge of methods of securing wells with casing and cement slurries.

16. Organization and management of drilling works: To teach students to plan, organize and manage drilling works.

17. Economic evaluation of drilling: To teach students to carry out economic analysis and evaluation of the efficiency of drilling works.

18. Environmental Safety: To give knowledge about the environmental aspects of drilling and methods of minimizing the negative impact on the environment.

19. Study of special drilling methods: To teach students to apply special drilling methods (directional and horizontal drilling, drilling with hydraulic fracturing, etc.).

20. Preparation to work with modern software: To provide skills in using modern software for design, modeling and analysis of drilling processes.

These tasks are aimed at preparing comprehensively developed specialists capable of working effectively in various conditions and solving complex technical problems arising in well drilling.

3 Requirements for assessment of learning outcomes of the educational program

The graduate of this educational program is awarded the academic degree of Bachelor of Natural Science

- The graduate of the department of “Petroleum Engineering” on the educational program of Bachelor's degree 6B07223 - “Drilling of wells for solid minerals and water” should know:

General requirements for assessment:

1. Objectivity: Assessment should be based on clear criteria and procedures that exclude subjectivity and faculty bias.

2. Systematic: Assessment should be conducted regularly and systematically throughout the course of study, not just at the end of a semester or course.

3. Comprehensiveness: Assessment should take into account various aspects of learning, including theoretical knowledge, practical skills, problem-solving skills, and communication and analytical abilities.

4. Variety of assessment methods: A variety of assessment methods should be used to evaluate students' knowledge and skills from different perspectives (written exams, oral exams, practical work, laboratory work, term projects, presentations, tests, etc.).

5. Transparency: Evaluation criteria and assessment procedures should be clearly defined and communicated to students.

6. Feedback: Instructors should provide students with feedback on assessment results to help them understand their strengths and weaknesses and identify ways to further improve.

7. Compliance with the requirements of the Federal State Educational Standard: Assessment of learning outcomes should comply with the requirements of the Federal State Educational Standard (if applicable) and other regulatory documents.

8. Consideration of professional standards: When conducting the assessment it is necessary to take into account the requirements of professional standards that determine the qualification of specialists in the field of drilling.

Requirements for assessment of theoretical knowledge:

9. Knowledge of basic concepts and terms: Assessment of knowledge of basic concepts, terms and definitions used in the field of drilling.

10. Understanding of the principles of equipment operation: Assessment of understanding of the principles of operation of drilling rigs, equipment and tools.

11. Knowledge of technological processes: Assessment of knowledge of technological processes of drilling, well support, preparation and application of drilling fluids and other technological operations.

12. Knowledge of geologic and hydrogeologic conditions: Assessment of knowledge of the geologic structure of the subsurface, rock properties, and hydrogeologic conditions of the drilling area.

13. Knowledge of methods of data evaluation and analysis: Assessment of knowledge of methods of analysis and interpretation of geological, geophysical and technical data obtained in the process of drilling.

14. Knowledge of safety norms and rules: Assessment of knowledge of norms and rules of safety, labor protection and industrial safety during drilling.

Requirements for assessment of practical skills:

15. Ability to perform technological operations: Assessment of the ability to perform basic technological operations, including drilling, well anchoring, flushing, running and lifting tools.

16. Ability to work with equipment: Assessment of the ability to work with drilling rigs, equipment and tools.

17. Drilling Fluids Selection and Application: Assesses the ability to select and apply various types of drilling fluids and flushing fluids.

18. Ability to Analyze Data and Draw Conclusions: Assessment of the ability to analyze technical data obtained during the drilling process and draw conclusions based on it.

19. Complications Management Skills: Assesses the ability to apply methods of dealing with complications encountered in the drilling process.

20. Teamwork: Assesses the ability to work effectively in a team with other specialists.

21. Safety skills: Assessment of the ability to comply with the requirements of occupational health and safety during drilling operations.

Research and project skills assessment requirements:

22. Ability to formulate research problems: Assessment of the ability to formulate research problems in the field of drilling.

23. Ability to plan and conduct research: Assessment of the ability to plan and conduct research studies in the field of drilling.

24. Skill in analyzing and interpreting results: Assessment of the ability to analyze and interpret research results.

25. Project Development Skills: Assesses the ability to develop drilling projects, including technical and economic feasibility studies.

26. Project Defense: Assesses the ability to defend one's projects and research results in front of an audience.

These learning outcomes assessment requirements are designed to ensure that drilling professionals are highly skilled and competitive, capable of working effectively in a variety of industries and solving complex technical problems.

4. Passport of the educational program

4.1. General information

№	Field name	Note
1	Code and classification of the field of education	6B072 "Engineering, manufacturing and construction industries".
2	Code and classification of training areas	6B072 Industrial and manufacturing branches
3	Group of educational programs	B071 Mining and mineral extraction
4	Name of the educational program	6B07223 - "Drilling of wells for solid minerals and water"
5	Brief description of the educational program	It is intended for implementation of profile training of bachelors in the educational program "Drilling of wells for solid minerals and water" Satbayev University. The educational program prepares highly qualified specialists capable of working effectively in various industries where well drilling is required. The program provides fundamental knowledge in geology, physics and engineering, as well as practical skills in working with modern drilling equipment and technologies. Graduates of the program will be ready for independent work at drilling sites, service companies and research organizations.
6	Purpose of (EP)	To train highly qualified specialists with deep theoretical knowledge and practical skills necessary for design, management and leadership in the development of modern drilling technologies, methods of geological research and data analysis to develop strategies for the search for and evaluation of mineral deposits and groundwater based on the principles of labor safety, rational use of natural resources, compliance with environmental standards and support for sustainable development, taking into account inclusion and gender equality
7	Type of EP	New
8	The level of the NRK:	6
9	ORC Level:	6
10	Distinctive features of the EP	no
11	List of competencies of the educational program: General cultural competences (GC): GC -1 Ability to apply abstract concepts and models to solve practical problems. GC -2 Readiness for continuous professional development and advanced training. GC -3 Ability to conduct a constructive dialog, to present one's point of view in a reasoned manner and to listen to others. GC -4 Understanding of the social significance of one's profession and the consequences of one's activity GC -5 Ability to distribute responsibilities and coordinate teamwork. GC -6 Respect for cultural differences and traditions. GC -7 Ability to use information technologies to solve professional problems. GC -8 Development of aesthetic taste and artistic perception. GC -9 Ability to choose the most optimal solution from several alternatives. General professional competences (GPC): GPC -1 Analytical competence: Ability to collect, analyze and interpret information, identify patterns, problems and opportunities, formulate sound conclusions and make decisions based on data analysis. Includes the ability to critically evaluate the information obtained, highlight key aspects and make logical connections. GPC -2 Communicative competence: The ability to interact effectively with others, to express one's thoughts and ideas clearly, convincingly and correctly, both orally and in writing. It includes the ability to actively listen, understand and take into account the positions of interlocutors, conduct	

	negotiations and presentations. GPC -3 Organizational competence: The ability to organize one's own work and the work of others, to plan and control tasks, to use resources effectively, to manage time and priorities. Includes the ability to create and implement plans, delegate tasks, and control their execution, optimize processes. GPC -4 Professional competence in drilling (specialized): Knowledge and application of basic technologies, methods and equipment used in the process of drilling wells, as well as understanding of geological and hydrogeological conditions. This includes the ability to select optimal drilling technologies and methods, identify and solve problems encountered during the drilling process, and evaluate the safety of operations. This competency will be specifically developed and varied depending on the particular educational program and the specifics of drilling operations. Professional Competencies (PC): PC 1 Selection and application of drilling technologies: Ability to select optimal drilling technologies (vertical, directional, horizontal, etc.) depending on geological conditions, technical requirements and economic factors. PC 2 Work with drilling equipment: Ability to operate, maintain and repair drilling rigs, tools and auxiliary equipment. PC 3 Drilling process management: Ability to control drilling parameters, ensure the specified well trajectory, and perform necessary technological operations. PC 4 Well support technology: Knowledge and ability to apply well fastening technology with casing and cement slurries. PC 5 Preparation and application of drilling fluids: Ability to select, prepare, control and use different types of drilling fluids and flushing fluids. PC 6 Prediction and elimination of complications: Ability to predict possible complications in the drilling process and apply methods of their prevention and elimination. PC 7 Geological support of drilling: Understanding of the geological structure of the drilling area, ability to analyze geological information and interpret drilling data. PC 8 Analysis and evaluation of drilling results: Ability to analyze technical data obtained during drilling, draw conclusions and develop recommendations for process optimization. PC 9 Technical planning of drilling operations: Ability to develop plans of drilling works, including selection of drilling technology, calculation of necessary resources and timing of works. PC 10 Organization of drilling operations: Ability to organize the work of the drilling team, distribute responsibilities and control the performance of tasks. PC 11 Compliance with health and safety requirements: Knowledge and ability to apply norms and rules of health, safety and industrial safety during drilling operations. PC 12 Economic evaluation of drilling operations: Ability to conduct economic evaluation of drilling operations, calculate costs and determine the effectiveness of the technologies used.
12	Educational Program Learning Outcomes: RO 1. Understands economic, environmental and inclusive principles of sustainable development, as well as a systems approach for developing professional and cultural competencies, analyzing information, working in teams, and ensuring safe working conditions during drilling operations RO 2. Carries out business and social communication in the state, Russian and foreign languages, demonstrating respect for historical, ethical, philosophical, and social values of society, and contributes to strengthening intercultural diversity and promoting inclusive education RO 3. Applies knowledge in geology, hydrogeology, mining engineering, materials science, and modern technologies for designing and controlling drilling operations, conducting experiments, and analyzing data to support optimal engineering decisions and sustainable use of natural resources RO 4. Applies theoretical and practical knowledge in the field of physics and mathematics, natural sciences and information technology to analyze modern problems, form an engineering worldview, make informed decisions and improve technological processes in the field of drilling and exploration of groundwater and minerals RO5. Applies scientific research methods and modern approaches to design and implement innovative technologies in well drilling, ensuring improved quality and safety of operations while considering economic, environmental, and anti-corruption requirements RO6. Applies the norms of subsoil and subsoil use legislation when planning and organizing drilling operations, taking into account industrial safety and environmental protection requirements RO7. Ensures technical maintenance and repair of drilling equipment, monitors the process of drilling fluid injection, safe working conditions, and the elimination of drilling consequences at the well in

	accordance with regulatory requirements RO8. Applies knowledge of geological structure, hydrogeology, and exploration methods to select optimal drilling sites, assess aquifers, and ensure sustainable use of water resources with consideration of energy efficiency RO9. Applies skills in operating modern drilling equipment and technical maintenance to improve technological efficiency and ensure sustainable development of industrial infrastructure RO 10. Carries out selection and monitoring of data on geological structure, rock properties, and characteristics of aquifers to optimally plan drilling operations and minimize risks RO 11 Utilizes specialized software solutions and digital technologies to create geological structure models, process data, and develop drilling projects for ore and hydrogeological wells, supporting the implementation of innovations and digital transformation in the mining sector RO12. Conducts research activities in the field of ore and hydrogeological well drilling aimed at introducing technological innovations, improving energy efficiency, and modernizing industrial infrastructure based on the principles of sustainable development	
13	Form of training	full - time
14	Duration of training	4 years
15	Volume of loans	240
16	Languages of instruction	Russian/Kazakh
17	Academic degree awarded	Bachelor of Engineering and Technology
18	Developers and authors:	Ratov B.T., Muratova S.K., Arshidinova M.T., Smashov N.Zh., Omirzakova E.Zh.

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

№	Name of the discipline	Brief description of the discipline	Num ber of credit	Generated learning outcomes (codes)											
				RO1	RO2	RO3	RO4	RO5	RO6	RO7	RO8	RO9	RO10	RO11	RO12
Cycle of general education disciplines/Compulsory component															
1	Foreign Language	English is a compulsory subject. According to the results of placement test or IELTS score, students are placed into groups and disciplines. The name of the discipline corresponds to the level of English. When passing from level to level, prerequisites and postrequisites are respected.	10	+	+	+									
2	Kazakh (Russian) language	The course covers the alphabet, sounds and letters, phonetic and intonational means of language, basic word-formation, morphological and syntactic units and the conditions of their use. Considers: listening, reading, writing and speaking. The course provides 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 spoken speech based on the simultaneous development of the basics of grammar and vocabulary in the course of constant repetition with a gradual complication of tasks.	10	+	+	+									
3	Physical Culture	The purpose of the discipline is to master the forms and methods of forming a healthy lifestyle within the framework of the professional education system. Familiarization with the natural-scientific basics of physical education, knowledge of modern health-improving technologies, basic methods of independent physical education and sports. As part of the course, the student will master the rules of judging in all sports.	8	+	+										
4	Information and communication technologies	Goal: Students will master the basics of information processes, modern technologies and data protection methods within the discipline of information and communication technologies.	5			+								+	+

		Contents: Study of text and spreadsheet editors, databases, introduction to the Python programming language. Additionally - the basics of network technologies, data transfer protocols, information security and setting up operating systems. Practical classes include labs on setting up network connections, working with databases, and developing programs in Python.													
5	History of Kazakhstan	The purpose of the course of the history of Kazakhstan is to give objective historical knowledge about the main stages of the history of modern Kazakhstan; to focus students' attention on the problems of the formation and development of statehood and historical and cultural processes. The course tells about the history of Kazakhstan covering five main chronological periods, from the Stone Age to the present. During the study of the course, an opportunity is given to analyze the features and contradictions of the history of Kazakhstan in various periods, as well as the opportunity to reveal the historical content of the foundations of the laws of political, socio-economic, cultural processes from antiquity to the present stage. During the study of the course, great importance is given to the formation of an active civic position of students. The course is aimed at the humanization of technical education and is due to the huge role in strengthening the Kazakh identity, self-awareness of the people, the implementation of tasks related to the need for an intellectual breakthrough among the younger generation in the new millennium. Through an in-depth study of the history of Kazakhstan, the student learns to conduct an objective analysis of the development of the domestic historical process. At the same time, upon completion of the course, the student can use the acquired analytical knowledge and value orientations in everyday practice.	5	+	+	+									
6	Philosophy	The purpose of the discipline is to teach students the theoretical foundations of philosophy as a way of knowing and spiritually mastering the world;	5	+	+	+									

		developing their interest in fundamental knowledge, stimulating the need for philosophical assessments of historical events and facts of reality, assimilating the idea of the unity of the world historical and cultural process while recognizing the diversity of their skills in applying philosophical and general scientific methods in professional activities.													
7	Socio-political knowledge module (sociology, politology)	The course is dedicated to the study of general political, sociological and psychological knowledge for bachelors of technical direction. Examines: political self-awareness, improving one's political outlook and communicative competences; basic sociological theories and the most effective ways to develop sociological imagination, understanding of the main concepts of sociology as a science	3	+	+	+	+								
8	Socio-political knowledge module (culturology, psychology)	Cultural studies provides a basis for the study of the whole complex of social sciences and humanities, as well as a supplement to general courses in history and philosophy. The course includes questions: morphology, semiotics, anatomy of culture; culture of nomads of Kazakhstan, cultural heritage of proto-Türks, medieval culture of Central Asia, formation of Kazakh culture, Kazakh culture in the context of globalisation, cultural policy of Kazakhstan, etc. based on the application of psychology in practice, in various spheres of life: personal, family, professional, business, public, in work with people	5	+	+	+	+			+					
Cycle of general education disciplines															
Elective component															
9	Fundamentals of anti-corruption culture and law	Purpose: to increase the 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. Contents: improvement of socio-economic relations of the Kazakh society, psychological features of corrupt behavior, formation of an anti-corruption culture, legal responsibility for acts of corruption in various fields.	5		+		+								
10	Fundamentals of scientific research	Purpose: The goal of studying the discipline is to develop students' research skills; to introduce					+	+							+

	methods	students to scientific knowledge, their readiness and ability to conduct research. Objectives of studying the discipline: to contribute to the deepening and consolidation of existing theoretical knowledge by students; to develop practical skills in conducting scientific research, analyzing the results obtained and developing recommendations; to improve methodological skills in independent work with information sources and appropriate software and hardware.												
11	Fundamentals of economics and entrepreneurship	Purpose: To develop basic knowledge of economic processes and skills in entrepreneurial activities. Content: The course aims to develop skills in analyzing economic concepts such as supply and demand, and market equilibrium. It includes the basics of creating and managing a business, developing business plans, risk assessment, and strategic decision-making.		+				+		+				
12	Ecology and life safety	Purpose: formation of ecological knowledge and consciousness, obtaining theoretical and practical knowledge on modern methods of rational use of natural resources and environmental protection. Contents: the study of the tasks of ecology as a science, 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, ways to solve environmental problems; life safety in the technosphere, emergencies of a natural and man-made nature.		+				+		+				
13	Fundamentals of Financial literacy	Purpose: formation of financial literacy of students on the basis of building a direct link between the acquired knowledge and their practical application. Contents: 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.		+				+		+				

Cycle of general education disciplines/ University component														
14	Mathematics I	Purpose: to introduce students to the fundamental concepts of linear algebra, analytical geometry and mathematical analysis. To form the ability to solve typical and applied problems of the discipline. Contents_ Elements of linear algebra, vector algebra and analytical geometry. Introduction to the analysis. Differential calculus of a function of one variable. The study of functions using derivatives. Functions of several variables. Partial derivatives. The extremum of a function of two variables.	5			+	+			+				
15	Physics	Purpose: to study the basic physical phenomena and laws of classical and modern physics; methods of physical research; the influence of physics on the development of technology; the relationship of physics with other sciences and its role in solving scientific and technical problems of the specialty. Contents: mechanics, dynamics of rotational motion of a solid body, mechanical harmonic waves, fundamentals of molecular-kinetic theory and thermodynamics, transfer phenomena, continuum mechanics, electrostatics, direct current, magnetic field, Maxwell's equations.	5			+	+	+						
16	Mathematics II	Purpose: To teach students integration methods. To teach you how to choose the right method for finding the primitive. To teach how to apply a certain integral to solve practical problems. Contents_ integral calculus of the function of one and two variables, series theory. Indefinite integrals, methods of their calculation. Certain integrals and applications of certain integrals. Improper integrals. Theory of numerical and functional series, Taylor and Maclaurin series, application of series to approximate calculations_	5			+	+			+				
17	Engineering and computer graphic	Purpose: To develop students' knowledge of drawing construction and skills in developing graphical and textual design documentation in accordance with standards. Content: Students will study ESKD standards, graphic primitives, geometric constructions, methods	5				+	+						+

		and properties of orthogonal projection, Monge's projection, axonometric projections, metric tasks, types and features of connections, creating part sketches and assembly drawings, detailing, and creating complex 3D solid objects in AutoCAD.													
18	General and structural geology	Purpose: to study the material composition of the Earth, geodynamic processes and forms of occurrence of rocks. Objectives: study of the material composition of the Earth, mineralogical, chemical; geodynamic exogenous and endogenous processes, forms of occurrence of igneous, sedimentary, metamorphic rocks, patterns of their location and consistency, geological conditions of formation, faults, general patterns of development of the earth's crust.	4			+	+			+		+			
19	Resistance of materials	The purpose of the discipline is to form a set of knowledge in the field of engineering calculations with simple and complex resistance to strength, rigidity and stability of structural elements that ensure the required reliability and safety of products under static and dynamic loads. The content of the discipline: The main provisions of the resistance of materials. Stretching and compression. Geometric characteristics. Theory of stress and strain state. Hypotheses of strength. Shear, torsion and shear. The bend. Combinations of basic deformations. Bending with stretching or compression. Fatigue resistance. Strength under dynamic loads. Stability of compressed rods.	5				+					+			
20	The theoretical mechanics	The purpose of the discipline is to form the foundations of engineering thinking among students by studying the basics of mechanics and mastering the basic principles and laws of theoretical mechanics The content of the discipline: the basic laws of mechanical motion and mechanical interaction of material bodies; the basic concepts of the law of mechanics, methods for studying the equilibria of motion of a material point, a solid and a mechanical system	5				+					+			
21	Drilling machines and mechanisms	Purpose: Characterizes modern types of drilling complex equipment, methods of their operation and	5							+		+			

		repair, schemes for calculating the influence of auxiliary units parameters during drilling operations. Content: Assessment of the technical condition of drilling equipment, as well as identification of problems with the operability of drilling equipment and providing a set of solutions to eliminate identified problems and recommendations for their prevention.												
22	Drilling Process Control and Management	The purpose of the discipline is to effectively manage the process of well drilling and constant control over the prevention of accidents, reduce downtime, non-productive time and reduce the time of well construction. The content of the discipline: Control of the technological process of drilling wells, by measuring with special instruments, namely, measuring weight, load, speed, fluid and gas flow, drilling speed, etc. Analysis of the property and function of the elements used in the technological control of the exploration drilling process. Calculation of well drilling process	6			+	+			+			+	
23	Oil and gas well drilling	Purpose: providing fundamental and necessary knowledge of drilling processes, technologies and well construction, covering the operation of equipment and drilling methods. Contents: the discipline covers: a review of drilling work, including various methods and approaches; study of drilling rig components; detailed examination of the drill string and drill bits; reservoir pressure analysis and well control methods; training in well casing techniques, well cementing processes, and features of drilling fluids. The course also includes sections on drilling hydraulics, directional and offshore drilling, allowing students to better understand the specifics and technologies of drilling in various conditions.	5				+	+				+		
24	Drilling wells for solid minerals	Purpose: The purpose of studying the discipline is to gain knowledge about modern technologies, equipment and tools for drilling wells in the exploration of solid mineral deposits Contents: Drilling of wells for solid minerals. The course introduces students to the technology of	5			+	+			+			+	

		drilling wells for solid minerals. The issues of typification of geological and technical conditions of deposits are considered. Determination of physical and mechanical properties of rocks. Determination of fracturing and the degree of stability of rocks. The choice of the method of drilling wells for field exploration, depending on the stage of exploration. The procedure for designing the structure of wells. Determination of drilling mode parameters for different drilling methods. Measures to increase the yield of the core. Designing the optimal design of wells. Selection of drilling equipment. Measures to prevent various complications and ways to eliminate them.												
25	Water well drilling	The purpose of the discipline is to study the methods of drilling geological exploration, technical wells and water wells. The discipline 'Drilling of water wells' covers the basic technologies and methods of drilling, as well as the features of the equipment used. Possible complications arising during drilling operations and their impact on further operation of wells are studied. Methods of improving the quality of wells, reducing the cost of their construction, and the hydrogeological basis of water abstraction are considered. The course emphasises regulatory requirements, environmental aspects and practical issues related to the design, drilling and construction of water wells.	4			+					+		+	
26	Fluid mechanics in drilling	Purpose: The main goal of studying the discipline "Fluid mechanics in drilling" is to form the necessary initial knowledge base for students about the laws of equilibrium and movement of fluids, to acquire skills for calculating forces acting on the walls of tanks, hydraulic calculation of pipelines for stationary and non-stationary regimes of fluid flow, laws of flow through holes and nozzles, solving technological problems as part of training in the oil and gas specialty Contents: The course "Fluid mechanics in drilling" considers the rheological models of drilling fluids, thixotropy of fluids, the effect of solids concentration,	5			+				+		+		+

		temperature and pressure on the rheological properties of drilling fluids, the pressure of viscoplastic fluids on the walls and bottom of the well, the pressure on the bottom and walls of the well filled with carbonated fluid, sticking of the drill string due to hydrostatic pressure, fluid flow regimes, jet effect of bit nozzles, drill cuttings carryover.													
27	Educational practice	The training practice is the first stage of training specialists in the field of drilling wells for solid minerals and water. During the internship, students get acquainted with the main types of drilling equipment, master the principles of drilling exploration and water intake wells, study the design of drilling rigs, flushing systems and drilling tools. The practice is aimed at developing students' initial skills and understanding of the organization of drilling operations in the field.	2	+	+	+	+	+	+	+	+	+	+	+	+
Cycle of basic disciplines Elective component															
28	Introduction to drilling	Purpose: To develop an entry-level knowledge of well drilling, the basics of well control, selection of drilling tools and familiarisation with important standards used in drilling. Content: The course covers the components of a drilling rig, simple calculations of rig dimensions, description of drilling fluids, principles of drill bit selection, directional drilling plans and tools that are used for this technology.	5	+	+	+	+				+				
29	Fundamentals of mining	The purpose of the discipline is to provide students with knowledge about the parameters of mining excavations, technology and organisation of their implementation. The content of the discipline: to form concepts and knowledge of the construction of underground and surface facilities of mining enterprises. Students will learn to choose types of mine workings depending on the type and type of mineral deposit, depth and shape of occurrence, to determine the strength, deformation and energy-consuming indicators of rock destruction	5			+			+					+	
30	Physics of rock mass	Purpose: to study the influence of physical, mechanical and chemical properties of rocks on	5	+		+	+								

		mining operations. Content: compilation of rock strength passport using the Coulomb-Mohr method, mechanical properties of rocks, rock stresses and Deformation; acoustic, electrical, magnetic and thermal properties of rocks, the influence of external factors on these properties; use of active learning methods such as case studies, problem solving, brainstorming.													
31	Geology of mineral deposits	Purpose: Formation of students' theoretical knowledge and practical skills necessary for the study of geological conditions of occurrence of minerals, estimation of their reserves and mastering the methods of prospecting and exploration of deposits. Mastering modern approaches to the analysis of the genesis of deposits, their classification and distribution patterns. The content of the discipline includes the study of regularities of formation and location of deposits, their classification and structural features. Methods of prospecting and exploration of mineral resources, geological and economic evaluation of deposits, as well as modern development technologies are considered. Special attention is paid to mineral resource base, environmental aspects of subsoil use and application of geological data for rational development of natural resources.	5			+				+		+			
32	Geology of oil and gas	Goal: To teach students methods of geology. Learn how to choose the right method to solve a problem..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			+					+		+		
33	Drilling of geotechnological wells	Purpose: providing students with in-depth knowledge and practical skills in the field of engineering and technology of drilling, construction and design of	6	+			+	+		+					

		geotechnological wells. Contents: the discipline examines issues related to the construction of geotechnological wells, that is, it covers in detail the technique and technology of drilling, the construction and design of wells for underground leaching of metals and salts, hydraulic mining of ores, underground sulfur smelting, underground gasification of coal and shale, fastening, opening and development of productive horizons, downhole and wellhead equipment. Issues of safety and environmental protection are also considered.													
34	Legal basis for subsoil use	The purpose of studying the discipline is to form students' understanding of legal norms and legislative acts regulating relations in the field of subsoil use, as well as to provide knowledge necessary to comply with the legislation in the exploration, extraction and protection of minerals. Content: The discipline includes the study of legislation (e.g. the Law 'On Subsoil' in RK), international agreements, rights and obligations of the state and subsoil users, licensing, taxation and environmental requirements. Dispute resolution mechanisms, liability for violations and comparative analyses of legislation in different countries are considered. Students gain knowledge for the lawful and efficient use of subsoil resources, minimising the risks associated with violations of legislation.	6			+			+						
35	Drilling Fluids and Cementing Mixtures	Purpose: To obtain basic knowledge in the theory of the main technological processes associated with the use of drilling washing and plugging fluids, necessary to ensure environmental safety and economic efficiency of the drilling process. Content: The discipline allows to competently choose the type of drilling and cement solutions for specific geological conditions during drilling and completion of wells, to determine the area of application of different types of drilling and cement solutions, the methodology for determining the operational properties, to develop a solution formulation, to experimentally find the composition of the solution	5				+					+		+	

		for drilling and completion of wells. to find a solution with given properties, to calculate the required amount of materials for the preparation of solutions, to select equipment for the preparation of drilling and completion of wells, to find a solution with given properties, to calculate the required amount of materials for the preparation of drilling and completion of wells.													
36	Metrology, standardization and certification	The purpose of the discipline is to form knowledge and skills necessary to ensure the accuracy of measurements, compliance of technological processes with established standards and quality control of drilling operations. The content of the discipline includes the study of methods of metrological support in the measurement of drilling parameters, control characteristics of drilling equipment and tools. Standards regulating requirements to drilling fluids, casing, cementing and other technological processes are considered. Attention is also paid to certification of materials, equipment and technologies ensuring reliability and safety of drilling operations. Industrial safety of oil and gas production	5						+					+	+
37	Geoecological Monitoring	Purpose: study of methods and technologies used for observation, analysis and assessment of the state of the natural environment and ecosystems Contents: Concept of monitoring, meaning, types, functions, goals and objectives of GM. Methods for assessing the state of the environment. Equipment and technology of geoecological monitoring. Instruments and methods for monitoring environmental quality. Identification of zones of geoecological crisis. A set of environmental monitoring methods. Methods of geophysical, geochemical, biological, agrochemical, landscape research	5	+				+	+		+				

38	Digital modelling of drilling processes	Objective: to form students' skills of graphical interpretation of processes accompanying drilling, design of drilling tools and equipment, construction of three-dimensional models suitable for modelling, as well as calculations of geometrical parameters of drilling process systems, modelling, as well as calculations of geometric parameters of drilling process systems. Acquisition of skills of three-dimensional virtual modelling, visualisation of the obtained results and carrying out of scientific researches on their basis scientific research on their basis. Content: Basic concepts of modelling methods. Application of computer modelling in drilling. The basis of computer modelling methodology. System of three-dimensional design KOMPAS-3D. Modern software systems.	4				+	+						+	+
39	Energy saving in drilling technologies	Objective: to form a comprehensive understanding of the principles and methods of energy saving in the processes of drilling oil and gas wells. Content: Topicality of the problem of energy saving in the oil and gas industry. Analysis of energy consumption in drilling processes. Energy-saving technologies in mechanical drilling and in the circulation system. Energy saving in power supply of drilling rigs. Energy saving in heat supply of drilling rigs. Energy audit and energy management at drilling enterprises. Regulatory and legal framework in the field of energy saving.	4	+				+			+				+
40	3D computer modelling in drilling	Purpose of the discipline: Introduction of students to the principles and methods of three-dimensional computer modelling for design, analysis and optimisation of drilling processes, as well as development of skills in working with modern modelling software. Summary: - Basic concepts and principles of three-dimensional modelling. - Overview of popular software solutions (Petrel, Schlumberger, AutoCAD, etc.). - Basics of working with modelling tools.	4			+		+		+				+	

		Construction of geological models. - Modelling of drilling trajectories and well designs. - Use of 3D models for prediction and prevention of complications. - Optimisation of drilling parameters on the basis of modelling. - Methods of visualisation of modelling results. - Data interpretation for decision making.													
41	Environmental engineering for well drilling	Purpose: To develop a comprehensive understanding of the environmental issues arising from oil and gas well drilling Content: Environmental problems associated with drilling wells. Sources and types of environmental pollution during drilling. Impact of drilling operations on the components of the natural environment. Methods of ecological risk and environmental impact assessment. Environmental monitoring and control during drilling.	4	+				+	+	+					
42	Fundamentals of scientific research and optimisation of drilling processes	Purpose: Formation of students' knowledge and skills necessary for scientific research in the field of drilling for solid minerals. Mastering the methods of optimisation of drilling processes aimed at increasing their efficiency, reducing costs, minimising complications and improving the quality of field opening. Content: Methodology of scientific research: stages, principles, methods. Methods of data collection and analysis in scientific research. Modelling of drilling processes. Methods of statistical analysis and planning of experiments. Optimisation of technological drilling processes. Methods of decision-making in conditions of uncertainty. Innovative approaches in drilling technologies.	6					+							+
43	Organisation, planning and management of geological exploration works	Purpose: To develop a comprehensive understanding of the principles, methods and tools of organisation, planning and management of geological exploration works (GEO).		+				+					+		

		Content: Basic principles and methods of exploration project management. Structure and stages of geological exploration. Types and methods of geological exploration works. Planning of geological exploration works. Organisation of geological exploration. Exploration project management. Economic justification of geological exploration. Modern trends in the organisation and management of geological exploration.	6												
Cycle of specialised disciplines University component															
44	Hydrogeology and engineering geology of mineral deposits	Goals and objectives of the discipline: The purpose of studying the discipline is to master the knowledge of waters deep horizons, their genesis, dynamics, mineral composition of formation waters of oil and gas basins in general and near-contour waters of oil and gas deposits. Objectives of studying the discipline: give an analysis of the current state and prospects for the development of the discipline; examine hydrogeological conditions and patterns of placement of oil and gas accumulations inside the basins; hydrodynamic and hydrochemical relationships between groundwater and hydrocarbon deposits and their mutual action in the development process; classification of oil and gas prospecting hydrogeological indicators; oil and gas field classification of waters; hydrogeological foundations of underground gas storage and disposal of industrial effluents.	5			+	+				+		+		
45	Drilling deviated and multilateral wells	Formation of students' theoretical knowledge and practical skills necessary for designing, drilling and operation of deviated and multilateral wells. Mastering of modern technologies of well trajectory control, methods of optimisation of drilling processes and increasing the efficiency of field development. The discipline 'Drilling of deviated and multilateral wells' includes the study of technologies and methods of drilling deviated wells, their design features and areas of application. The methods of borehole	5			+	+	+				+			

		trajectory control, selection of drilling equipment and tools, as well as methods of prevention and elimination of complications are considered. Particular attention is paid to multi-borehole technologies, which help to improve the efficiency of field development, minimise costs and increase the mineral recovery factor. Modern digital drilling monitoring technologies and environmental aspects of drilling operations are also studied.													
46	Complications and accidents when drilling for TPIs	Objective: to form a comprehensive understanding of the causes, mechanisms of occurrence and consequences of complications and accidents arising during drilling for solid minerals (SM). Content: Classification of complications and accidents by causes and mechanisms of occurrence. Complications associated with geological, technological, hydrogeological factors. Methods of prevention of complications and accidents. Methods of elimination of complications and accidents. Organisation of work on prevention and elimination of complications and accidents.	6				+		+	+					
47	Geosteering in drilling	Purpose: The study of the theoretical foundations, navigation and telemetry systems, as well as technical means of controlling the profile of the wellbore when drilling inclined and horizontal wells. Contents: The course covers the fundamentals of telemetry, measurement and logging while drilling and directional drilling technologies, criteria for selecting the minimum required logging dataset before performing geosteering, errors and uncertainties when drilling horizontal wells associated with both geology and limitations of telemetry and logging tools, as well as methods for calculating the well trajectory, modern methods of geosteering, basics of interpretation of azimuthal logs, modeling of various geosteering scenarios before drilling commences in order to manage risks, geosteering in real time on-the-job.	5			+	+	+						+	
Cycle of specialised disciplines															
Elective component															
48	Rational use of natural	The aim of the discipline is to prepare students for	4	+					+				+		

	resources	efficient and environmentally safe use of natural resources. Mastering the methods of rational resource management aimed at their conservation, sustainable use and minimisation of environmental damage. Discipline content: covers the basic principles and methods of natural resources management, including water, minerals, forest and land resources. Ways of their efficient use, minimising losses, as well as issues of environmental protection and sustainable development are considered. Environmental, economic and social aspects of resource management, as well as conservation and reproduction strategies are explored. Special attention is paid to legislation and international standards in the field of environmental management.													
49	Fundamentals of mining	The purpose of the discipline is the formation of knowledge and skills of students in the field of safe development of mineral deposits by open pit mining. The content of the discipline: mastering by students of mining terminology, basic principles of extraction and enrichment of solid minerals, basic technological processes and basic equipment of open pits, underground mines and enrichment plants; to give concepts of the basics of enrichment and processing of minerals.	5			+	+								
50	Theoretical basics of the drilling process	The purpose of studying the discipline is to acquire and master knowledge, the formation of practical skills, according to the basic terms and definitions of geological exploration; methods of drilling geological, technical wells, water wells; the basics of well drilling technology; possible complications arising during well drilling and further affecting their operation; normative, technological and instructive documentation for geological exploration; basic rules of industrial safety in the course of geological exploration; the peculiarities of the functioning of engineering and technical services for the control and management of geological exploration. know: methodology for designing technology and choosing equipment for drilling wells in specific geological and technical conditions;	5			+	+	+					+		

		be able to: choose the right technical means, tool and analyze the method of exploration drilling, to solve problems in the given mining and geological conditions.													
51	Pre-diploma/Pre-project analysis	Purpose: Acquisition of skills of reasonable choice of the topic of the thesis (or project), based on the relevance of the problem, novelty and practical significance. Content: Analysis of current problems in the chosen subject area. Analysis of the subject area. Formulation of goals and objectives. Review of existing solutions. Justification of research (design) methods. Formation of the structure of the thesis (or project). Formalisation of the results of pre-diploma (or pre-project) analysis. Preparation for the defence of the results of pre-diploma (or pre-project) analysis	6					+						+	+
52	Modern instrumental methods of research	Purpose: Formation of students' theoretical knowledge and practical skills in the use of modern instrumental research methods to solve scientific and applied problems. The discipline 'Modern Instrumental Methods of Research' covers the study and application of advanced methods of analysis and diagnostics in various fields of science and technology. The course covers physico-chemical, spectroscopic, microscopic and other research methods. Special attention is paid to interpretation of the obtained data, selection of optimal techniques and combination of different methods for complex analysis of objects. Students will learn to work with modern equipment and software, understand the principles and applications of methods such as mass spectrometry, X-ray structural analysis, atomic force microscopy and others.	6					+	+						+
53	Innovative technologies in geological exploration works	The aim of the discipline is to introduce students to modern instrumental methods used for the study of physical, chemical and biological processes. To master various approaches and technologies used to analyse materials and objects, as well as to solve scientific and engineering problems. Discipline content: covers methods of analysis and	5				+		+					+	

		measurement used in various fields of science and technology. Methods such as spectroscopy, chromatography, microscopy, X-ray diffraction, mass spectrometry and other instrumental techniques are considered. The principles of operation, applications and capabilities of each technique are explored, as well as ways of processing and interpreting the data obtained.													
54	Foreign market of well drilling equipment and technology	The discipline " Foreign market of well drilling equipment and technology " contributes to the formation of oil and gas engineers who are able to competently choose modern equipment and technology in drilling and completion of wells, as well as competently evaluate the results of their construction in accordance with foreign standards.	5		+					+		+			
55	Environmental aspects of subsoil use	The purpose of the discipline is to prepare students to analyse the environmental consequences of subsoil use activities, to master the methods of minimising the negative impact on the environment and rational use of natural resources. Discipline content: studies the impact of mining on ecosystems, including pollution of water resources, soil and atmosphere. Methods of preventing and minimising environmental damage are considered, as well as reclamation of disturbed land. Legal and environmental norms regulating subsoil use activities and international standards of environmental protection are studied.	5	+		+		+	+						
56	Fundamentals of design in drilling	Objective: to form students' comprehensive understanding of the principles of design and calculation of the main elements of drilling equipment and tools Content: The main stages of the design process. Materials for drilling equipment. Basics of strength and stability calculation. Drill strings. Casing strings. Drilling bits. Drilling motors. Ejection control equipment. Modern trends in drilling equipment design.	5			+	+	+		+		+			
57	Drilling equipment design	Objective: to form a comprehensive understanding of the principles of design, construction and calculation of the main elements of drilling equipment	5			+	+			+					

		Content: Basic concepts, definitions and design principles. Drilling equipment design process. Materials for drilling equipment. Fundamentals of strength and stability calculation. Design and calculation of the main elements of drilling equipment. Certification of drilling equipment. Formalisation of design documentation. Modern trends in the design and standardisation of drilling equipment													
58	Materials science for drilling equipment	Purpose: To develop a comprehensive understanding of the properties, characteristics and application of various materials used in the manufacture of drilling equipment and tools Content: Classification of materials used in drilling equipment. Metal, polymeric, composite, ceramic materials. Physical and mechanical properties of materials. Corrosion and wear of materials. Methods of testing and quality control of materials. Selection of materials for drilling equipment.	5			+				+		+			
59	Well logging	Purpose: increasing the level of professional knowledge, skills and abilities of students in the field of field geophysical surveys of wells as a method of borehole observations and their use in a complex of geological and geophysical work Contents: Fundamental principles of rock physics, types of logging tools, openhole analysis, determination of permeability, reservoir evaluation without shale and shale sand formations, determination of water saturation, Archie equation, reservoir pay, oil and gas saturation, recoverable reserves, drilling fluid logging principles, acoustic logs, neutron logs, resistivity and density logs, and lithological plots.	5			+		+			+		+		
60	Offshore drilling	Objective: to study the specific technologies, equipment, and methods used in offshore well drilling that ensure the safety and efficiency of developing oil and gas fields on the continental shelf. Content: includes features of offshore drilling: types of drilling platforms (fixed, semi-submersible, jack-up), offshore drilling rigs, technologies for drilling in open sea conditions, well casing and sealing,	5				+		+	+		+			

		environmental and weather considerations, safety systems, and relevant international standards and regulations.													
61	Reservoir geomechanics	Objective: To develop students' ability to analyze, synthesize and design elements of a production system to assess the impact of drilling on the distribution of stresses in a productive formation. Contents: Basic concepts of formation geomechanics. Calculation of formation and geostatic pressures. Destruction of rocks under compression, tension and shear. Calculations for determining horizontal stresses, the angle of internal friction and the coefficient of friction	5				+	+		+	+				
62	Fundamentals of Artificial Intelligence	Purpose: to familiarize students with the basic concepts, methods and technologies in the field of artificial intelligence: machine learning, computer vision, natural language processing, etc. Contents: general definition of artificial intelligence, intelligent agents, information retrieval and state space exploration, logical agents, architecture of artificial intelligence systems, expert systems, observational learning, statistical learning methods, probabilistic processing of linguistic information, semantic models, natural language processing systems.	5			+		+		+				+	
63	Fundamentals of development and operation of oil and gas fields	Objective: to master the methods of designing, developing and operating oil and gas fields using modern technologies to enhance oil recovery for analysis and regulation of development. Content: Methods of studying and modeling oil and gas reservoirs as objects of development. Technologies for extracting oil and gas from the subsurface. Creation of oil and gas field development systems. Comprehensive technical and economic methods of field development design. Methods of analysis and regulation of development	5			+	+		+		+				
64	Rock destruction while drilling wells	Objective: Mastering the physical and mechanical properties of rocks, analyzing the processes of their destruction during drilling for the selection of modern drilling equipment Content: Methods for determining the physical and mechanical characteristics of rocks, analysis of the mechanisms of their destruction at the	6	+		+	+								

		bottom of the well with various drilling methods. Designs of modern drill bits and crowns. Equipment and core sampling. Development of criteria for the selection of drilling tools, taking into account mining and geological conditions. Methods for predicting the performance of drilling tools and evaluating the effectiveness of their use													
65	Reconstruction and workover of wells	Purpose: To provide students with theoretical knowledge of well workover operations, as well as practical skills in the management and execution of workover operations, including rig operations, pressure testing, well control and stimulation techniques. Contents: the course covers the basic aspects of workover operations, including the use and maintenance of key equipment such as wellheads and blowout preventers, and also details drilling rig operations such as running, moving, hoisting and receiving the rig, and testing pressure, well killing techniques and well clean-out techniques, as well as wireline and fishing operations, various acidizing and stimulation techniques, the use of cement plugs and specific types of well completions for workover scenarios are also covered.	6			+	+			+					
66	Well testing	Purpose: formation of students' knowledge about the basic principles of well test; formation of skills in interpreting well test data and evaluating reservoir parameters. Content: This course covers the study of physical principles, technology of execution and methods of interpretation of the results of modern complex hydrodynamic tests of wells; solving problems of determining the main characteristics of formations to identify the condition and analysis of the bottomhole zone of wells.	5				+				+		+	+	
67	Industrial internship I	The first production internship is the initial immersion of students in the production activities of enterprises engaged in drilling wells for solid minerals and water. During the internship, students participate in the preparation of the drilling site, the assembly and adjustment of equipment, the development of technological operations for drilling and sampling. They get acquainted with the process	2	+	+	+	+	+	+	+	+	+	+	+	+

		of maintaining geological and technical documentation, the specifics of drilling in various geological conditions and the requirements of occupational safety. Practice builds practical skills and helps strengthen professional knowledge.													
68	Industrial internship II	The second industrial (pre-graduate) internship is aimed at consolidating professional skills and preparing students to complete their final qualifying work. Students take part in complex drilling and exploration work, analyze technical and geological data, evaluate the effectiveness of the drilling technology used and the condition of the equipment. The practice provides for the collection and systematization of materials necessary for research, as well as the formation of students' independence, responsibility and readiness for professional activity in real production.	3	+	+	+	+	+	+	+	+	+	+	+	+

5. CURRICULUM

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



«APPROVED»
Decision of the Academic Council
NPJS C«KazNRTU»
named after K.Satbayev»
dated 18.06.2025 Minutes № 17

WORKING CURRICULUM

Academic year
Group of educational programs
Educational program
The awarded academic degree
Form and duration of study

2025-2026 (Autumn, Spring)
B071 - "Mining and mineral extraction"
6B07223 - "Drilling of wells for solid minerals and water"
Bachelor of engineering and technology
full time - 4 years

Discipline code	Name of disciplines	Block	Cycle	Total ECTS credits	Total hours	lek/lab/pr Contact hours	in hours SIS (including TSIS)	Form of control	Allocation of face-to-face training based on courses and semesters								Prerequisites	
									1 course		2 course		3 course		4 course			
									1 sem	2 sem	3 sem	4 sem	5 sem	6 sem	7 sem	8 sem		
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)																		
M-1. Module of language training																		
LNG108	Foreign language		GED, RC	5	150	0/0/45	105	E	5									
LNG104	Kazakh (russian) language		GED, RC	5	150	0/0/45	105	E	5									
LNG108	Foreign language		GED, RC	5	150	0/0/45	105	E		5								
LNG104	Kazakh (russian) language		GED, RC	5	150	0/0/45	105	E		5								
M-2. Module of physical training																		
KFK101	Physical culture I		GED, RC	2	60	0/0/30	30	E	2									
KFK102	Physical culture II		GED, RC	2	60	0/0/30	30	E		2								
KFK103	Physical culture III		GED, RC	2	60	0/0/30	30	E			2							
KFK104	Physical culture IV		GED, RC	2	60	0/0/30	30	E				2						
M-3. Module of information technology																		
CSE677	Information and communication technology		GED, RC	5	150	30/15/0	105	E			5							
M-4. Module of socio-cultural development																		
HUM101	History of kazakhstan		GED, RC	5	150	15/0/30	105	E		5								
HUM134	Module of socio-political knowledge (cultural studies, psychology)		GED, RC	5	150	30/0/15	105	E			5							
HUM132	Philosophy		GED, RC	5	150	15/0/30	105	E				5						
HUM120	Module of socio-political knowledge (sociology, political science)		GED, RC	3	90	15/0/15	60	E				3						
M-5. Module of anti-corruption culture, ecology and life safety base																		
CHE656	Ecology and life safety	1	GED, CCH	5	150	30/0/15	105	E				5						
MNG489	Fundamentals of economics and entrepreneurship	1	GED, CCH	5	150	30/0/15	105	E				5						
PET519	Fundamentals of scientific research methods	1	GED, CCH	5	150	30/0/15	105	E				5						
HUM136	Fundamentals of anti-corruption culture and law	1	GED, CCH	5	150	30/0/15	105	E				5						
MNG564	Basics of Financial Literacy	1	GED, CCH	5	150	30/0/15	105	E				5						
CYCLE OF BASIC DISCIPLINES (BD)																		
M-6. Module of physical and mathematical training																		
MAT101	Mathematics I		BD, UC	5	150	15/0/30	105	E	5									
PHY468	Physics		BD, UC	5	150	15/15/15	105	E	5									

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MAT102	Mathematics II		BD, UC	5	150	15/0/30	105	E	5								MAT101
M-7. Module of basic training																	
GEN429	Engineering and computer graphics		BD, UC	5	150	15/0/30	105	E	5								
GPH499	Introduction to drilling	1	BD, CCH	5	150	30/0/15	105	E	5								
GPH500	Fundamentals of mining	1	BD, CCH	5	150	30/0/15	105	E	5								
GEO198	General and structural geology		BD, UC	4	120	30/15/0	75	E		4							
AAP173	Practical training		BD, UC	2				R		2							
GEN468	Applied Mechanics		BD, UC	5	150	30/0/15	105	E		5							
GPH523	Rock destruction while drilling wells	1	BD, CCH	6	180	30/0/30	120	E		6							
MIN180	Physics of rock mass	1	BD, CCH	6	180	15/30/0	135	E		6							
GEO699	Geology of mineral deposits	2	BD, CCH	5	150	30/15/0	105	E		5							
GIN159	Geology of oil and gas	2	BD, CCH	5	150	30/15/0	105	E		5							
CSE831	Fundamentals of Artificial Intelligence	2	BD, CCH	5	150	15/0/30	105	E		5							
GEN467	Resistance of materials		BD, UC	5	150	30/0/15	105	E			5						
GPH540	Hydrogeology and engineering geology of mineral deposits		BD, UC	4	120	30/0/15	75	E			4						
GPH539	Theoretical basics of the drilling process	1	BD, CCH	6	180	30/0/30	120	E			6						
GPH502	Legal legal framework for subsoil use	1	BD, CCH	6	180	30/0/30	120	E			6						
PET412	Oil and gas well drilling		BD, UC	5	150	30/15/0	105	E				5					
PET457	Drilling wells for solid minerals		BD, UC	5	150	30/0/15	105	E				5					
GPH504	Water Well Drilling		BD, UC	4	120	30/0/15	75	E				4					
GPH501	Drilling Process Control and Management		BD, UC	5	150	30/0/15	105	E				5					
PET527	Reservoir geomechanics	1	BD, CCH	5	150	30/0/15	105	E				5					
GPH505	Digital modelling of drilling processes	1	BD, CCH	5	150	30/0/15	105	E				5					
GPH529	Metrology, standardization and certification	2	BD, CCH	5	150	30/0/15	105	E				5					
GPH460	Geoeological Monitoring	2	BD, CCH	5	150	30/15/0	105	E				5					
PET529	Fluid mechanics in drilling		BD, UC	5	150	30/0/15	105	E					5				
GPH503	Drilling Fluids and Cementing Mixtures	1	BD, CCH	4	120	30/0/15	75	E					4				
GPH506	Energy saving in drilling technologies	1	BD, CCH	4	120	30/0/15	75	E						4			
GPH507	3D computer modelling in drilling	2	BD, CCH	4	120	30/0/15	75	E						4			
PET528	Fundamentals of development and operation of oil and gas fields	2	BD, CCH	4	120	30/15/0	75	E						4			
GPH531	Drilling machines and mechanisms	1	BD, CCH	6	180	30/0/30	120	E							6		
PET461	Reconstruction and workover of wells	1	BD, CCH	6	180	30/15/15	120	E							6		
CYCLE OF PROFILE DISCIPLINES (PD)																	
M-8. Module of professional activity																	
AAP102	Production practice I		PD, UC	2				R				2					
AAP183	Production practice II		PD, UC	3				R						3			
PET530	Geosteering in drilling		PD, UC	5	150	30/15/0	105	E					5				
GPH102	Well logging	1	PD, CCH	5	150	30/15/0	105	E						5			
GPH511	Rational use of natural resources	1	PD, CCH	5	150	30/0/15	105	E						5			
GPH512	Environmental engineering for well drilling	2	PD, CCH	5	150	30/0/15	105	E						5			
MIN101	Bases of mining (Introduction to specialty)	2	PD, CCH	5	150	15/0/30	105	E						5			
GPH508	Fundamentals of scientific research and optimisation of drilling processes		PD, UC	5	150	30/0/15	105	E							5		

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GPH509	Drilling deviated and multilateral wells		PD, UC	5	150	30/0/15	105	E								5		
GPH510	Complications and accidents when drilling for TPIs		PD, UC	5	150	30/0/15	105	E								5		
GPH513	Pre-diploma/Pre-project analysis	1	PD, CCH	6	180	30/0/30	120	E								6		
GPH514	Modern instrumental methods of research	1	PD, CCH	6	180	30/0/30	120	E								6		
GPH515	Organisation, planning and management of geological exploration works	2	PD, CCH	5	150	30/0/15	105	E								5		
GPH516	Innovative technologies in geological exploration works	2	PD, CCH	5	150	30/0/15	105	E								5		
PET533	Foreign market of well drilling equipment and technology	1	PD, CCH	5	150	30/0/15	105	E									5	
GPH517	Environmental aspects of subsoil use	1	PD, CCH	5	150	30/0/15	105	E									5	
GPH518	Fundamentals of design in drilling	2	PD, CCH	5	150	30/0/15	105	E									5	
PET442	Well testing	2	PD, CCH	5	150	30/15/0	105	E									5	
GPH520	Drilling equipment design	3	PD, CCH	5	150	30/0/15	105	E									5	
GPH521	Materials science for drilling equipment	3	PD, CCH	5	150	30/0/15	105	E									5	
GPH541	Drilling of geotechnological wells	4	PD, CCH	5	150	30/0/15	105	E									5	
GPH522	Offshore drilling	4	PD, CCH	5	150	30/0/15	105	E									5	
M-9. Module of final attestation																		
ECA103	Final examination		FA	8													8	
Additional type of training (ATT)																		
AAP500	Military training																	
Total based on UNIVERSITY:										32	28	28	32	29	31	32	28	
										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	0	5	56
BD	Cycle of basic disciplines	0	64	46	110
PD	Cycle of profile disciplines	0	25	41	66
Total for theoretical training:		51	89	92	232
FA	Final attestation				8
TOTAL:					240

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Minutes № 7 dated 10.06.2025

Decision of the Academic Council of the Institute. Minutes № 8 dated 30.04.2025

Signed:

Governing Board member - Vice-Rector for Academic Affairs

Uskenbayeva R. K.

Approved:

Vice Provost on academic development

Kalpeyeva Z. B.

Head of Department - Department of Educational Program
Management and Academic-Methodological Work

Zhumagaliyeva A. S.

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

Auyelkhan Y. .

Department Chair - Geophysics and seismology

Ratov B. T.

Representative of the Academic Committee from Employers

Khitrov D. M.

____ Acknowledged ____

