Institute of «Geology and Oil and Gas Business»

Department of «Petroleum Engineering»

EDUCATIONAL PROGRAM

6B07214 «Drilling engineering»

Code and classification of the field of education: 6B07 «Engineering, Manufacturing and Civil engineering»
Code and direction of personnel training: 6B072 «Manufacturing and processing»
Group of educational programs: 6B271 «Oil and gas major»
Level on NQF: 6
Level on SQF: 6
Period of study: 4
Volume of the credits: 240

Almaty 2023

Educational program 6B07214 «Drilling Engineering» approved at the meeting of the Academic Council of KazNRTU named after K.I.Satpayev.

Protocol no. 5 from 2022 y. "24" 11

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

Protocol no. 3 from 2022 y. "17" 11

Educational program 6B07214 «Drilling Engineering» developed by the academic committee in the direction of 6B072 «Manufacturing and processing».

Full name	Academic degree/ academic title	Position, course	Place of work, contact	Note
Chairman:				
Yeligbaeva Gulzhakhan Zhakparovna	Doctor of Chemical Sciences, professor	Head of the Department	NJSC «Kazakh National Research Technical University named after K.I.Satpayev»	
Teaching staff:				
Abdeli Dairabay Zhumadilovich	Doctor of Technical Sciences, professor	Professor	NJSC «Kazakh National Research Technical University named after K.I.Satpayev»	
Moldabayeva Gulnaz Zhaksylykovna	Doctor of Technical Sciences, professor	Professor	NJSC «Kazakh National Research Technical University named after K.I.Satpayev»	
Baymukhametov Murat Abyshevich	Candidate of Physical and Mathematical Sciences, docent	Associate Professor	NJSC «Kazakh National Research Technical University named after K.I.Satpayev»	
Moldabekov Murat Smanovich	PhD	Associate Professor	NJSC «Kazakh National Research Technical University named after K.I.Satpayev»	
Smashov Nurlan Zhaksibekovich	Candidate of Technical Sciences, docent	Associate Professor	NJSC «Kazakh National Research Technical University named after K.I.Satpayev»	

Imansakipova Nurgul Beketovna	PhD	Senior Lecturer	NJSC «Kazakh National Research Technical University named after K.I.Satpayev»	
Yskak Ardak Sergazievna	PhD	Senior Lecturer	NJSC «Kazakh National Research Technical University named after K.I.Satpayev»	
Employers:				
Nysangaliyev Amangali Nysangalievich	Doctor of Technical Sciences, professor, Academician of the National Engineering Academy of the Republic of Kazakhstan	Director of the Center for Ground Design	JSC «Kazakh Institute of Oil and Gas»	
Bekbauov Bakbergen Yermekbaevich	PhD	Leading Researcher, Modeling Service	«KMG Engineering» LLP	
Nurkas Zhasulan Bolatzhanuly		Director	LLP «Manul»	
Students:				
Mahsut Beknur	Student of the educational program 6B07214 «Drilling Engineering»	1st year (after college)	NJSC «Kazakh National Research Technical University named after K.I.Satpayev»	

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List of abbreviations and designations

EP – Educational program

NQF – National Qualifications Framework

IQF – Industry Qualifications Framework

KC – Key competencies

PC – Professional competencies

MIOR – Methods of increasing oil recovery

1. Description of the educational program

The Educational program (hereinafter, EP) is a set of documents developed by the Kazakh National Research Technical University named after K.I. Satpayev and approved by the Ministry of Education and Science of the Republic of Kazakhstan. The EP takes into account the needs of the regional labor market, the requirements of state bodies and relevant industry requirements and is based on the state educational standard for higher professional education in the relevant field.

The EP defines the program educational goals, the learning outcomes of students, the necessary conditions, content and technologies for the implementation of the educational process, assessment and analysis of the quality of students during training and after graduation.

The EP includes the curriculum, the content of disciplines and learning outcomes and other materials to ensure quality education of students.

The purpose of the development of the EP "Drilling Engineering" is to assist students, teachers and industry experts

2. The purpose and objectives of the educational program

Purpose of the EP: The purpose of the educational program is to form highly qualified specialists for the oil and gas industry with a high level of competence, comprehensively developed, with broad technical knowledge and skills in the field of technology and technology of drilling oil and gas wells, as well as drilling wells for solid minerals and water.

EP tasks:

1. To train specialists who will be able to apply knowledge of mathematics, science and technology, as well as identify, formulate and solve engineering problems to improve the technological processes of the oil and gas industry.
2. To instill in students knowledge of research methodology (setting research goals, data collection, data processing and transformation, data examination, model building and method selection, presentation and visualization of results)

3. Develop the ability to extract the necessary information from various sources, including information flows in real time, analyze it for further decision-making and see logical connections in the system of collected information.
4. Train students to effectively communicate information and thoughts to other people.
5. To instill in students the desire for independent learning and the manifestation of a high level of competence in engineering principles and in practice.
6. To instill in students the skills of working in different industry and multicultural communities
7. To develop the graduates', need to live and practice ethical, social and environmental standards in their professions in a responsible manner.

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

The educational program has been developed in accordance with the State Mandatory Standards of Higher and Postgraduate Education, approved by Order No. 2 of the Minister of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022 (registered in the Register of State Registration of Normative Legal Acts under No. 28916) and reflects the learning outcomes on the basis of which curricula are developed (working curricula, individual curricula of students) and working curricula in disciplines (syllabuses).

The assessment of learning outcomes is carried out according to the developed test tasks within the framework of the educational program in accordance with the requirements of the state mandatory standard of higher and postgraduate education.

When evaluating learning outcomes, uniform conditions and equal opportunities are created for students to demonstrate their knowledge, skills and abilities.

4. Passport of the educational program

4.1. General information

№	Field name	Note
1	Code and classification of the field of education	6B07 «Engineering, manufacturing and construction industries»
2	Code and classification of training areas	6B072 «Manufacturing and processing industries»
3	Group of educational programs	6B271 «Oil and gas business»
4	The name of the educational program	6B07214 «Drilling engineering»
5	Brief description of the educational program	The Drilling Engineering educational program is aimed at training specialists in the field of drilling oil and gas wells and other liquid resources through pipelines. The program provides for the study of a wide range of subjects from fundamental sciences (mathematics, physics, geology, chemistry) to the principles of engineering analysis, design and management, includes the disciplines of principles of drilling technology, mechanics, design of drilling fluids, ensuring environmental friendliness and rationality during man-made developments. The subjects of professional activity of the EP are deposits and enterprises engaged in the development and operation of oil and gas fields.
6	The purpose of the EP	The purpose of the educational program is to form highly qualified specialists for the oil and gas industry with a high level of competence, comprehensively developed, with broad technical knowledge and skills in the field of technology and technology of drilling oil and gas wells, as well as drilling wells for solid minerals and water.
7	EP Type	New EP
8	National Qualifications Framework Level	6
9	Level by Industry Qualifications Framework	6
10	Distinctive features of the EP	no

11	List of competencies of the educational program:	1. To have the skills to work and apply professional knowledge in interdisciplinary teams; 2. To understand professional and ethnical responsibility in the process of working in labor communities; 3. Be able to conduct experiments, as well as analyze and interpret experimental data to develop optimal solutions; 4. Be able to analyze modern problems and determine the principles of improving drilling processes; 5. To have effective communication skills in professional and public organization; 6. Be able to identify, formulate and solve technical problems when drilling oil and gas fields, deposits of solid minerals, as well as water wells; 7. To have skills of life long professionals learning; 8. Be able to apply knowledge of mathematics, science and technology to solve professional problems of drilling and well operation; 9. To have the skills of designing technological processes for drilling oil and gas fields, as well as drilling wells for solid mineral and water to achieve the tasks set; 10.Understand the consequences of technical solutions when drilling wells and developing oil and gas fields, deposits of solid minerals, as well as water wells in a economic, environmental and social context; 11.Be able to use the methods, skills and modern engineering tools necessary for engineering practice.
12	Learning outcomes of the educational program:	1. To have the skills to work and apply professional knowledge in interdisciplinary teams; 2. To understand professional and ethnical responsibility in the process of working in labor communities; 3. Be able to conduct experiments, as well as analyze and interpret experimental data

		to develop optimal solutions; 4. Be able to analyze modern problems and determine the principles of improving drilling processes; 5. To have effective communication skills in professional and public organization; 6. Be able to identify, formulate and solve technical problems when drilling oil and gas fields, deposits of solid minerals, as well as water wells; 7. To have skills of life long professionals learning; 8. Be able to apply knowledge of mathematics, science and technology to solve professional problems of drilling and well operation; 9. To have the skills of designing technological processes for drilling oil and gas fields, as well as drilling wells for solid mineral and water to achieve the tasks set; 10.Understand the consequences of technical solutions when drilling wells and developing oil and gas fields, deposits of solid minerals, as well as water wells in a economic, environmental and social context; 11.Be able to use the methods, skills and modern engineering tools necessary for engineering practice.
13	Form of study	Full-time
14	Period of study	4
15	Volume of the credits	240
16	Volume of the credits	Kazakh, Russian
17	Degree to be conferred	Bachelor
18	Developer and author:	G. Yeligbayeva

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

№	Name of discipline	Name of discipline	Credits	The formed educational outcomes (codes)										
				PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
Cycle of general education disciplines Required component														
1	Foreign language	English is a compulsary 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				v		v	v	v			
2	Kazakh (Russian) language	Kazakh (Russian) language In this course author considers socio-political, socio-cultural spheres of communication and functional styles of the modern kazakh (russian) language. The course covers the specifics of the scientific style to develop and activate professional communication skills and abilities of students. Also it allows students to leavn the basics of scientific style practically and develop the ability of production structural and semantic text analysis.	10				v		v		v	v		

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				**v**		**v**		**v**		**v**	**v**
4	Information and communication technologies	The aim of the course is to gain theoretical knowledge in information processing, the latest information technologies, local and global networks, the methods of information protection; Getting the right use of text editor editors and tabulators; creation of base and different categories of applications.	5				**v**		**v**	**v**	**v**			
5	History of Kazakhstan	The purpose of the discipline is to provide objective historical knowledge about the main stages of the history of Kazakhstan from ancient times to the present day; introduce students to the problems of the formation and development of statehood and historical and cultural processes; contribute to the formation of humanistic values and patriotic	5				**v**		**v**	**v**	**v**			

		feelings in the student; teach the student to use the acquired historical knowledge in educational, professional and everyday life; evaluate the role of Kazakhstan in world history.												
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; 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.	5				**v**		**v**		**v**		**v**	
7	Module of socio-political knowledge (sociology, political science)	The objectives of the disciplines are to provide students with explanations on the sociological analysis of society, about social communities and personality, factors and patterns of social development, forms of interaction, types and directions of social processes, forms of regulation of social behavior, as well as primary political knowledge that will serve as a theoretical basis for	3		**v**				**v**	**v**				

		understanding social -political processes, for the formation of political culture, development of a personal position and a clearer understanding of the extent of one's responsibility; help to master the political, legal, moral, ethical and socio-cultural norms necessary to act in the interests of society, form personal responsibility and achieve personal success.												
8	Module of socio-political knowledge (cultural studies, psychology)	The purpose of the disciplines is to study the real processes of cultural creative activity of people who create material and spiritual values, identify the main trends and patterns of cultural development, changes in cultural eras, methods and styles, their role in the formation of man and the development of society, as well as master psychological knowledge for the effective organization of interpersonal interaction, social adaptation in the field of their professional activities.	5							**v**	**v**	**v**	**v**	
Cycle of general education disciplines Component of choice														
1	Fundamentals of anti-corruption culture and law	The course introduces students to the improvement of socio-economic relations of Kazakhstan society, psychological features of corrupt behavior. Special	5	**v**	**v**								**v**	

		attention is paid to the formation of an anti-corruption culture, legal responsibility for acts of corruption in various spheres. The purpose of studying the discipline «Fundamentals of anti-corruption culture and law» is to increase public and individual legal awareness and legal culture of students, as well as the formation of a knowledge system and a civic position on combating corruption as an antisocial phenomenon. Expected results: to realize the values of moral consciousness and follow moral norms in everyday practice; to work on improving the level of moral and legal culture; to use spiritual and moral mechanisms to prevent corruption.												
2	Fundamentals of scientific research methods	Introduction. Science and scientific thinking. Basic concepts. The main categories of science. Science as a system of knowledge. Fact, hypothesis, theory, con-cept. Methodology, method, methodology. Scientific research. Technology of research work. Stages of scientific research. Technology of working with sci-entific literature. Presentation of research results. System approach, system thinking, system analysis.	5		**v**		**v**							

		General logical methods of research. Organization of scientific activity and scientific re-search. Implementation of the results of scientific research. Economic effi-ciency of scientific research.												
3	Fundamentals of economics and entrepreneurship	Discipline studies the foundations of economics and entrepreneurial activity from the point of view of science and law; features, problematic aspects and development prospects; the theory and practice of entrepreneurship as a system of economic and organizational relations of business structures; The readiness of entrepreneurs for innovative susceptibility. The discipline reveals the content of entrepreneurial activity, the stages of career, qualities, competencies and responsibility of the entrepreneur, theoretical and practical business planning and economic examination of business ideas, as well as the analysis of the risks of innovative development, the introduction of new technologies and technological solutions.	5	**v**	**v**								**v**	
4	Ecology and life safety	The discipline studies the tasks of ecology as a science, environmental terms, the laws of the functioning of natural systems	5	**v**	**v**		**v**						**v**	**v**

		and aspects of environmental safety in the conditions of labor activity. Monitoring of the environment and management in the field of its safety. Sources of pollution of atmospheric air, surface, groundwater, soil and ways to solve environmental problems; life safety in the technosphere; natural and man-made emergencies												
Cycle of basic disciplines University component														
1	Introduction to major	Introduction to basic concepts of petroleum engineering, including drilling and completion of wells, petroleum reservoir engineering, production engineering, surface gathering and treatment, and transportation and storage. и хранение углеводородов.	4		**v**					**v**				
2	Oil and gas geology	Oil and gas, and their physical properties. Genesis of petroleum. Migration of petroleum. Collection of oil and gas. Porosity. Permeability. Natural reservoirs of oil and gas. Deposits of oil and gas. Fields of oil and gas. Geophysical and geochemical methods of search for oil and gas geological structure and petroliferous of sedimentary basins of Kazakhstan. Distribution of oil	5				**v**	**v**		**v**			**v**	

		and gas reserves in earth core. Characteristic of zone of oil And gas resources.												
3	Details of cars	The basic requirements to details and knots of cars. Criterion of working capacity of details of cars and methods of their estimation. Concept of reliability and its basic indicators. Inter-changeability bases. Mechanical transfers and their classifications. Tooth gearings and their classification. Calculation of teeths of tooth gearings on durability. Worm gears and their classification. Calculation on durability of worm gears. Belt drives. Chain transfers. Shaft and axes. Calculation of shaft on durability. Bear-ings of sliding and качения. Selection of bear-ings качения. Connection kinds. Calculation on durability of connection.	5			v			v		v			
4	Engineering and computer graphics	The discipline is aimed at the study of methods for the image of objects and the general rules of drawing, using computer graphics; the study of the basic principles and geometric modeling approach and methodology for developing applications with a graphical interface; the formation of skills in the use of graphic systems for	5			v				v	v			v

		the development of drawings, using 2D and 3D modeling methods												
5	Mathematics I	The course is devoted to the study of the basic concepts of higher mathematics and its applications. The main provisions of the discipline are applied in the teaching of all general education engineering and special disciplines taught by graduate departments. The course sections include elements of linear algebra and analytical geometry, an introduction to analysis, differential calculation of functions of one and several variables. Methods for solving systems of equations, problems of using vector calculations in solving problems of geometry, mechanics, and physics are considered. Analytical geometry on a plane and space, differential calculation of functions of one variable, derivatives and differentials, study of the behavior of functions, derivative and gradient in direction, extremum of a function of several variables.	5						**v**		**v**			
6	Mathematics II	The discipline is a continuation of Mathematics I. sections of the course include integral calculus of a function of one variable and	5						**v**		**v**			

		several variables, series theory. Indefinite integrals, their properties and methods of their calculation. Certain integrals and their application. Incorrect integrals. Numerical series theory, functional series theory, Taylor and Macloren Series, application of series to approximate calculations.												
7	Fluid mechanics	This fundamental course introduces students to fluid flow in pipes, surface facilities and in oil and gas wells. Topics to be covered are compressible and incompressible flow, fluid statics, dimensional analysis, laminar and turbulent flows, Newtonian and non-Newtonian fluids and two-phase flow.	5			**v**						**v**		**v**
8	General and structural geology	Objectives of the discipline: the study of the material composition of the Earth; Geodynamic processes that form the face of the Earth and its various rocks; The study of the forms of occurrence of rocks in the earth's crust, the regularities of their location and combination, as well as the geological conditions of formation; Mastering the methods of compiling and reading geological, tectonic and structural maps, geological sections and block diagrams,	5					**v**		**v**		**v**		**v**

		stratigraphic columns; Obtaining an idea of the close relationship between the study of structural forms of rocks with the practice of geological exploration and with theoretical geology. The tasks of studying the discipline: mastering the skills and methods of studying the structure, origin and mutual relations of the forms of occurrence of rocks in the earth's crust; Obtaining of ideas and knowledge about the basic elements of geological structures, allowing to freely read geological, tectonic and structural maps of different scales; Development of skills to reproduce on the geological map the volume relationships of various structures (block diagrams, sections, geodynamic profiles, computer models of geological structures); Preparation for the passage of training and production practices.												
9	Chemistry	Purpose: formation of knowledge on fundamental issues of general chemistry and skills of their application in professional activity. Summary Laws, theoretical propositions and conclusions that underlie chemical disciplines; properties and relationships of chemical	5	**v**		**v**							**v**	

		elements based on the periodic law of D.I.Mendeleev and on modern ideas about the structure of matter; fundamentals of chemical thermodynamics and kinetics; processes in solutions; structure of complex compounds.												
10	Fundamentals of development and operation of oil and gas fields	This course covers material balance calculations for natural gas, retrograde condensate, black oil and volatile oil systems with and without a gas cap, water regime. Students will also learn analytical methods for reservoir performance prediction using material balance and decline curve analysis, fundamental principles of production engineering and technology, empirical models for decline curve analysis, and future performance of natural oil and gas wells. Some topics include artificial lift design, rod pumps, gas lift, PCPs, ESPs, nodal analysis.	4				**v**					**v**	**v**	**v**
11	Rock destruction while drilling wells	Knowledge of this discipline helps to correctly identify the physical and mechanical properties of rocks, to choose the most rational rock cutting tools (chisels, drill bits) and the technical means for coring of wells, to analyze the phenomena occurring during the formation of	5	**v**								**v**		**v**

		the well, to predict the performance of the drill												
12	Strength of materials	Stretching and compression. Pressure in sections and deformations of a direct core. Mechanical properties of materials at a stretching and com-pression. Calculation on durability and rigidity at a stretching-compression. Geometrical charac-teristics of flat sections. Shift and torsion. Cal-culation on durability and rigidity at torsion. A bend. Normal and tangents of a pressure at a bend. Calculation on durability at a bend. The theory of the intense and deformed conditions. A hypothesis of a limiting condition. Complex resistance. Stability of balance of deformable systems. Dynamic loading.	6						v		v			
13	Thermodynamics and heat engineering	The discipline studies the basic concepts and definitions of heat. The first and the second law of thermodynamics. Thermodynamic processes of ideal gases. A discharge throttling gases and vapors. The process of vaporization, P,V; T, S; h, s – diagram of water vapor. Thermodynamic cycles of thermal engines and plants. Heat transfer. The thermal	5	v							v			

		conductivity. Convective heat transfer. The heat transfer during forced and free motion of the fluid. Fundamentals of thermal calculation of heat exchangers.												
14	Drilling engineering	The discipline describes modern methods and technics of drilling oil and gas wells, drilling methods, well design, selection of a drilling scheme and calculation of the influence of parameters on the drilling method and the influence of drilling fluid on the operation of the bit, as well as their influence on the operating costs of drilling 1 meter. Students will also learn about the difficulties and problems in drilling and methods of their elimination, about inclined drilling, about offshore drilling and platform design, about technical and economic indicators during drilling, labor and environmental safety methods.	5				**v**		**v**		**v**		**v**	
15	Physics I	Objectives: to study the basic physical phenomena and laws of classical, modern physics; methods of physical research; the relationship of physics with other sciences. The following topics are considered: mechanics, dynamics of rotational motion of a solid body, mechanical harmonic	5			**v**			**v**		**v**			

		waves, fundamentals of molecular kinetic theory and thermodynamics, transport phenomena, continuum mechanics, electrostatics, direct current, magnetic field, Maxwell equations.												
16	Physics II	The course studies the laws of physics and their practical application in professional activity. Solving theoretical and experimental-practical educational problems of physics for the formation of the foundations in solving professional problems. Assessment of the degree of accuracy of the results of experimental or theoretical research methods, modeling of physical condition using a computer, study of modern measuring equipment, development of skills for conducting test studies and processing their results, distribution of the physical content of applied tasks of the future specialty.	5			v			v		v			
17	Petroleum and gas chemistry	Chemistry of oil and gas. The course examines the theoretical foundations of the chemistry of oil and gas, the physico-chemical properties of hydrocarbon raw materials. The main	5			v			v		v			

		technological methods of crude oil preparation. Methods and technology of separation of multicomponent systems. Chemical transformations of hydrocarbons. Methods of oil and gas refining necessary for practical solutions of physico-chemical problems arising at various stages of the oil chain. Economically feasible and environmentally friendly technologies for the preparation of crude oil for transportation and processing. Engineering calculation skills.											
Cycle of basic disciplines Component of choice														
1	Drilling of geotechnological wells	The discipline deals with the construction of geotechnological wells, that is, it covers in detail the technique and technology of drilling, 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, fixing, opening and development of productive horizons, downhole and wellhead equipment. The issues of safety and environmental protection are also considered.	6	**v**	**v**								**v**	

2	Drilling wells for liquid and gaseous minerals	The course considers issues related to the typification of geological conditions using small-scale classification sections, the choice of types and designs of bits, calculations of drill and collar pipes, assemblies of the bottom of the drill string, casing, drilling parameters. It also includes topics on justifying the choice of well design, type of drilling rig, type of drive for these rigs, selection of the receiving part of production strings, typical well profiles, as well as examples of solving typical problems in drilling wells for liquid and gaseous minerals.	5	**v**	**v**								**v**	
3	Drilling wells for solid minerals	Drilling of wells for solid minerals. The course introduces students to the technology of 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	5					**v**				**v**		**v**

		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.												
4	Drilling machines and mechanisms	The discipline studies the modern designs of equipment for drilling wells to oil and gas production, structure and main directions of further development of drilling machines and systems in accordance with the trends of the world technological progress; technological and normative-technical requirements to drilling machines and rigs the rules for their installation and dismantling, operation and maintenance. The article deals with evaluation of efficiency of machinery and equipment for choice of rational method of their operation. Technical level and ways to improve designs and methods of operation of drilling machines and complexes.	5	v			v		v					v
5	Reservoir geomechanics	This module expands on existing knowledge in the field of rock mechanics, in particular with regard to the systematic design of excavation work and support	5			v	v					v		

		systems in rock formations. It examines the strength and stress variability of rock mass at different scales and describes methods that engineers can use for long term planning and risk mitigation during drilling, production and reservoir engineering.												
6	Geosteering	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.	5				**v**					**v**	**v**	
7	Fluid mechanics in drilling	The course "Fluid mechanics in drilling" considers the rheological models of drilling fluids, thixotropy of fluids, the effect of solids concentration, 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	5			**v**			**v**					**v**

		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.												
8	Offshore deepwater drilling	The course " Offshore deepwater drilling" includes topics such as types of offshore platforms, offshore well design, offshore well construction technology, offshore drilling platform equipment, offshore well operation, offshore well drilling complications.	5	v					v					v
9	Fundamentals of the technology of drilling exploration wells	The discipline "Fundamentals of drilling technology for exploration wells" considers the issues of drilling operations in the exploration of minerals. The course considers well drilling modes, well construction technologies, well cleaning technologies during drilling, calculations for preparing wells for research, justification of well casing and casing strings, the basics of optimizing exploration drilling. The course examines in detail the issues of improving core acquisition.	5				v		v			v		

10	Reconstruction and workover of wells	This course covers the reasons for shutting down wells for underground workovers, the features of underground well workovers under various operating methods, the selection and justification of working fluids for killing wells. Equipment, aggregates, tools and technical means for carrying out underground repairs. In addition, it gives knowledge in assessing the quality of underground repairs and types of work on underground well workovers.	6						v		v			v
Cycle of profile disciplines University component														
1	Drilling fluids	The discipline includes such topics as the classification of drilling fluids, the main technological properties of drilling fluids, the influence of chemical treatment and external factors on the properties of drilling fluids, methods for controlling properties, choosing the density of drilling fluids, drawing up programs and technological regulations, circulation system, preparation and cleaning of drilling fluids .	5			v	v					v		
2	Completion engineering	This course will allow students to acquire knowledge and skills in the field of well casing and reservoir isolation: well design	6	v								v	v	

		selection, casing pipes, casing design and calculation, casing string cementing, cementing materials and equipment, well cementing calculation. Opening and testing of productive horizons. Development, testing and commissioning of wells. Technical project for the construction of a well on the sea.												
3	Well logging	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.	4	**v**		**v**	**v**	**v**			**v**			
4	Directional drilling	The study of the discipline gives the ability to cross the layers of rocks and mineral deposits in the most favorable direction, to avoid shallow directional wells and drill vertically-inclined bore for the sound profile, gives the opportunity to reel in deposits of the mineral at several points from the barrel, i.e. to drill multilateral wells.	5			**v**						**v**	**v**	

5	Well drilling in difficult conditions	The discipline belongs to special disciplines and enables the future specialist to gain knowledge and skills in applying modern drilling technologies that ensure high quality of exploration work in combination with high productivity of drilling operations carried out in difficult mining and geological conditions.	5				v		v					v
Cycle of profile disciplines Component of choice														
1	Accidents during drilling of exploration and geotechnological wells	The main topics of this course are: well drilling accidents, causes of accidents, well casing accidents, downhole motor accidents, drilling bit accidents, foreign objects falling into the well, accident investigation and accounting, accident prevention, blowout and open flow prevention , accident elimination, fishing tool, complications arising from well drilling	6		v			v					v	
2	Accidents during drilling of oil and gas wells	The main topics of this course are: general information about complications and accidents in the drilling process, drilling fluid losses, violations of the stability of the wellbore, grabbing and tightening of the pipe string, guttering, kicks, griffins and annular kicks, spontaneous curvature of the borehole and methods of prevention and	6		v			v					v	

		elimination of these complications and accidents.												
3	Well Construction Computer Simulation	This course is designed to teach the basics of well planning and drilling workflows on Petrel Well Design software, which includes core topics: reference well analysis, well design, well placement and real-time operations. As a result of the course, students receive the necessary skills and tools to improve the efficiency of work and the joint activities of specialists. Also, this course presents a new approach to the visualization of the drilling process.	4					v		v	v			
4	Well Stimulation	This practical course is designed for those involved in all aspects of well stimulation. To be better able to make decisions it is important to have a basic understanding of the types of formations and basic reservoir properties with which we deal. For this reason, time is spent in the early portion of the course setting the geological and reservoir property stage for vertical, horizontal, and multilateral wells prior to developing the basic formation damage, acidizing, and hydraulic fracturing concepts. The course	5			v	v				v			v

		includes acidizing and fracturing quality control, conducting the treatment, monitoring pressures, and other critical parameters during and after the treatment.												
5	Organization and management of oil and gas production	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. The course includes the search, analysis and use of regulatory and legal documents, step-by-step control over the implementation of business plans and the terms of agreements, agreements and contracts, coordination of the activities of performers using methodological tools for the implementation of management decisions in the field of organization and management to achieve high consistency in the implementation specific projects and works in the oil and gas industry.	5	**v**	**v**		**v**							
6	Fundamentals of Drilling Supervising	This course will allow students to acquire fundamental knowledge	5	**v**	**v**							**v**		

		and skills in the field of technological control and management of construction processes, maintenance and workover of oil and gas wells (supervising) in accordance with the technical design and work programs;												
7	Fundamentals of scientific research and optimization in drilling	The discipline "Fundamentals of Scientific Research and Optimization in Drilling" plays an important role in the preparation of bachelors of the educational program Drilling engineering. Knowledge of this discipline allows you to competently set up an experiment and process its results, learn how to represent real technological processes of drilling wells in the form of mathematical models. The processing of the latter using a PC allows you to quickly, at the engineering level, solve various problems that arise in the design and conduct of drilling operations.	5		**v**		**v**							
8	Drillind fluids in exploratory drilling	This course includes topics such as the influence of the quality of drilling fluids and the mode of well flushing on the efficiency of drilling technology, structure formation and deformation of drilling fluids, equipment and methods for measuring the	5			**v**	**v**					**v**		

		structural and mechanical properties of drilling mud, filtration of drilling fluids, indicators of properties and flow modes of drilling fluids, patterns of changes in structural and mechanical and filtration properties of drilling mud, types of drilling mud and materials for regulation, formulation and management of drilling mud properties.												
9	Petroleum Engineering seminar	Professional communication and research skills are essential qualities for future researchers. This course is aimed at developing the skills of oral and written communication, critical analysis of information and their processing, presentation and giving/receiving feedback from colleagues, as well as the preparation of scientific theses and articles	5	v	v			v						v
10	Measuring instruments in drilling	This course will allow students to acquire knowledge and skills in the issues of control and automation in well drilling. Gives the basic concepts and definitions of the theory of automatic control. The course covers elements of automation and instrumentation, automation of technological processes in well construction, variable drive in	5					v	v	v				

		well drilling, criteria and algorithms for controlling the drilling process, general information about automatic bit feed systems, optimal automatic control of the well drilling process, automation of tripping operations , operational reliability of control and automation equipment.												
11	Cement slurry systems	The discipline includes such topics as the classification and basic technological properties of cementing fluids and cement stone, the influence of chemical treatment and external factors on the properties of cement mixtures, methods for controlling properties, drawing up programs and technological regulations, and preparing cement mixtures.	5			**v**	**v**					**v**		
12	Quality management in drilling	The discipline "Quality Management in Drilling" examines the theoretical and practical foundations of quality management in drilling wells. The main topics studied are the theoretical foundations of product quality management, the theory and practice of well qualimetry, the methodology of quality management in drilling, the theoretical and practical issues of creating quality management systems in drilling, as well as	4					**v**						**v**

		assessing the conformity of quality in drilling.												

5. Curriculum of the educational program

KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after K.I. Satbayev

SATBAYEV UNIVERSITY

APPROVED
at the meeting of the Management Board
NJSC "Kazakh National Research Technical University named after K.Satpayev"
M.M. Begentayev
"12" 12 2023 y.

CURRICULUM
of Educational Program on enrollment for 2023-2024 academic year

Educational program 6B07214 - "Drilling engineering"
Group of educational programs 6B071 - "Oil and gas engineering"

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

Discipline code	Name of disciplines	Cycle	Total amount in credits	Total hours	Classroom amount lec/lab/pr	SIS (including TSIS) in hours	Form of control	Allocation of face-to-face training based on courses and semesters							
								I course		II course		III course		IV course	
								1 semester	2 semester	3 semester	4 semester	5semester	6 semester	7 semester	8 semester
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)															
M-1. Module of language training															
LNG 108	English language	GED, RC	10	300	0/0/6	210	E	5	5						
LNG 104	Kazakh (Russian) language	GED, RC	10	300	0/0/6	210	E	5	5						
M-2. Module of physical training															
KFK 101-104	Physical Culture	GED, RC	8	240	0/0/8	120	Difzach	2	2	2	2				
M-3. Module of information technology															
CSE 675	Information and communication technologies	GED, RC	5	150	2/1/0	105	E			5					
M-4. Module of socio-cultural development															
HUM 127	History of Kazakhstan	GED, RC	5	150	1/0/2	105	SE	5							
HUM 122	Philosophy	GED, RC	5	150	1/0/2	105	E			5					
HUM 126	Socio-political knowledge module (sociology, politology)	GED, RC	3	90	1/0/1	60	E			3					
HUM 124	Socio-political knowledge module (culturology, psychology)		5	150	2/0/1	105	E				5				
M-5. Module of anti-corruption culture, ecology and life safety base															
HUM 130	The base of anti-corruption culture and law	GED, CCH	5	150	2/0/1	105	E				5				
MNG 480	Fundamentals of economics and entrepreneurship														
PET509	Fundamentals of scientific research methods														
CHE 656	Ecology and life safety														
CYCLE OF BASIC DISCIPLINES (BD)															
M-6. Module of physical and mathematical training															
MAT 101	Mathematics I	BD, UC	5	150	1/0/2	105	E	5							
PHY 111	Physics I	BD, UC	5	150	1/1/0	105	E	5							
PHY 112	Physics II	BD, UC	5	150	1/1/1*	105	E		5						
MAT 102	Mathematics II	BD, UC	5	150	1/0/2	105	E		5						
M-7. Module of basic training															
PET499	Introduction to major	BD, UC	4	120	1/1/1*	75	E	4							
GEN 429	Engineering and computer graphics	BD, UC	5	150	1/0/2	105	E		5						
GEN443	Strength of materials	BD, UC	6	180	2/1/1*	120	E			6					
CHE395	Chemistry	BD, UC	5	150	2/0/1	105	E			5					
GEN416	Details of cars	BD, UC	5	150	2/0/1*	105	E			5					
GEO402	General and structural geology	BD, CCH	5	150	2/1/0*	105	E				5				
PET410	Fluid mechanics	BD, UC	5	150	1/1/1*	105	E				5				
CHE559	Petroleum and gas chemistry	BD, UC	5	150	2/1/0*	105	E				5				
GEO486	Oil and gas geology	BD, CCH	5	150	2/1/0*	105	E					5			
PET409	Thermodynamics and heat	BD, UC	5	150	1/0/2*	105	E					5			
PET471	Drilling engineering	BD, UC	5	150	2/0/1*	105	E					5			
PET474	Rock destruction while drilling	BD, UC	5	150	2/0/1*	105	E					5			
3214	Elective	BD, UC	5	150	2/0/1*	105	E					5			
3215	Elective	BD, CCH	5	150	2/0/1*	105	E					5			
3216	Elective	BD, UC	5	150	2/1/0*	105	E						5		
PET436	Fundamentals of development and operation of oil and gas fields	BD, CCH	4	120	2/1/0*	75	E						4		
3217	Elective	BD, CCH	5	150	2/1/0*	105	E						5		
4218	Elective	BD, CCH	6	180	2/1/1*	120	E							6	
PET367	Educational practice	BD, UC	2						2						
CYCLE OF PROFILE DISCIPLINES (PD)															
M-8. Module of professional activity															
PET479	Well logging	PD, UC	4	120	2/1/0*	75	E						4		
PET477	Drilling fluids	PD, UC	5	150	2/1/0*	105	E						5		
3305	Elective	PD, CCH	4	120	2/1/0*	75	E						4		
PET481	Completion engineering	PD, UC	6	180	2/1/1*	120	E							6	
PET480	Well drilling in difficult conditions	PD, UC	5	150	2/1/0*	105	E							5	
4306	Elective	PD, CCH	5	150	2/1/0*	105	E							5	
4307	Elective	PD, CCH	6	180	2/1/1*	120	E							6	
4308	Elective	PD, CCH	5	150	2/1/0*	105	E							5	
PET482	Directional drilling	PD, UC	5	150	2/0/1*	105	E								5
4310	Elective	PD, CCH	5	150	2/1/0*	105	E								5
4311	Elective	PD, CCH	5	150	2/1/0*	105	E								5
PET468	Production practice I	PD, UC	2								2				
PET506	Production practice II	PD, UC	3										3		
AAP110	Predegraible Practice	PD, UC	4												4

M-9. Module of final attestation																	
ECA108	Final attestation	FA	8														8
M-10. Module of additional types of training																	
AAP580	Military affairs	ATT	0														
Total based on UNIVERSITY:									31	29	31	29	30	30	33	27	
									60		60		60		60		

Number of credits for the entire period of study					
Cycle code	Cycles of disciplines	Credits			
		required component (RC)	university component (UC)	component of choice (CCH)	Total
GED	Cycle of general education disciplines	51		5	56
BD	Cycle of basic disciplines		86	26	112
PD	Cycle of profile disciplines		34	30	64
	Total for theoretical training:	*51*	*120*	*61*	*232*
FA	final attestation	8			8
	TOTAL:	59	120	61	240

Decision of the Academic Council of Kazmu named after K.Satpayev. Protocol № 5 24 november 2022 y.

Decision of the Educational and Methodological Council of Kazmu named after K.Satpayev. Protocol № 3 17 november 2022 y.

Decision of the Academic Council of the Institute_____. Protocol №2 от "21" 10 2022 y.

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

Institute Director — A.H. Svzdvkov

Head of the Department "Petroleum engineering" — G.Zh.Yelighayeva

Specialty Council representative from employers — N.A. Nysangaliev

MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN
KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY after K. SATBAYEV

SATBAYEV UNIVERSITY

APPROVED
Director of the Institute of Geology and Oil and Gas named after K.Turysov
A. Syzdykov
"1" 12 2022 y.

MAJOR ELECTIVE DISCIPLINES educational program for the 2023-2024 academic year admission
Educational program 6B07214 - "Drilling engineering"
Group of educational programs 6B271 - "Oil and gas major"

Full-time study Study duration : 4 years Academic degree: Bachelor of Engineering and Technology

Year of study	Code of elective	Code of discipline	Name of discipline	Semestr	Cycle	Credits	Total hours	lec/lab/pr	SIW (including SIWT) in	Prerequisites
			Module of basic training							
3	1	PET475	Drilling machines and mechanisms	5	B	5	150	2/0/1	105	
		PET453	Fundamentals of the technology of drilling exploration wells					2/0/1		
	2	PET454	Geosteering	5		5	150	2/0/1	105	
		PET456	Drilling wells for liquid and gaseous minerals					2/0/1		
	3	PET452	Offshore deepwater drilling	6		5	150	2/0/1	105	
		PET457	Drilling wells for solid minerals					2/0/1		
	4	PET501	Reservoir geomechanics	6		5	150	2/0/1	105	
		PET459	Fluid mechanics in drilling					2/0/1		
4	5	PET461	Reconstruction and workover of wells	7		6	180	2/1/1	120	
		PET462	Drilling of geotechnological wells					2/1/1		
			Module of professional activity							
3	6	PET460	Quality management in drilling	6	P	4	120	2/0/1	75	
		PET483	Well Construction Computer Simulation					2/1/0		
4	7	PET464	Cement slurry systems	7		5	150	2/1/0	105	
		PET465	Measuring instruments in drilling					2/1/0		
	8	PET470	Accidents during drilling of oil and gas wells	7		6	180	2/1/1	120	
		PET471	Accidents during drilling of exploration and geotechnological wells					2/1/1		
	9	PET468	Organization and management of oil and gas production	7		5	150	2/0/1	105	
		PET469	Drillind fluids in exploratory drilling					2/1/0		
	10	PET502	Well Stimulation	8		5	150	2/0/1	105	
		PET478	Fundamentals of Drilling Supervising					2/0/1		
			Module"R&D"							
	11	PET503	Petroleum Engineering seminar	8	P	5	150	2/1/0	105	
		PET463	Fundamentals of scientific research and optimization in drilling					2/0/1		

Credits numbers of elective disciplines over the entire period of study	
Cycle of disciplines	Credits
Cycle of basic disciplines (B)	26
Cycle of special disciplines (S)	30
Overall:	56

Decision of the Academic Council of the Institute_____ Protocol № 2 "14" 10 2022 г.

Head of the department "Petroleum Engineering" G.Zh.Yeligbayeva

Representative of Specialty council N.A. Nysangaliev