NON-PROFIT JOINT STOCK COMPANY "KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after K.I. SATABYEV"

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 construction industries»
Code and direction of personnel training: 6B072 «Industrial and manufacturing branches»
Group of educational programs: B271 «Oil and gas major»
Level on NQF: 6
Level on SQF: 6
Period of study: 4
Volume of the credits: 240

Almaty 2025

NON-PROFIT JOINT STOCK COMPANY "KAZAKH NATIONAL RESEARCH
TECHNICAL UNIVERSITY named after K.I. SATABYEV"

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

Protocol no. 10 from 20 24 y. " 3 " 06.

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

Protocol no. 5 from 20 24 y. " 20 " 12.

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

Full name	Academic degree/ academic title	Position	Place of work	Signature
Chairman:				
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Employers:				
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Table of contents

List of abbreviations and symbols

EP – Educational program
NQF – National Qualifications Framework
IQF – Industry Qualifications Framework
QC – Core Competencies
PC – Professional competencies
EVM – Electronic computer
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. Satbayev 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, on the professional standard.

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.

The professional standards for this educational program include:

1. Well surveying;
2. Well cementing;
3. Preparation of washing liquids;
4. Commissioning and repair works;
5. Maintenance and repair of special and field equipment;
6. Well maintenance.

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. The program focuses on the introduction of innovative and sustainable technologies that take into account the environmental, social and economic aspects of the industry, in accordance with the International Sustainable Development Goals (SDGs).

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 impart knowledge of research methodology to students (setting research goals, collecting data, processing and transforming data, examining data, building models and selecting methods, presenting and visualizing 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. To 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 practice.
6. To teach students the skills of working in different industry and multicultural teams.
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 assessing learning outcomes of an educational program

The educational program was developed in accordance with the State Compulsory Standards of Higher and Postgraduate Education, approved by order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022 No. 2 (registered in the Register of State Registration of Normative Legal Acts under No. 28916) and reflects the learning results, based on which develop curricula (working curricula, individual curricula for students) and working curricula for disciplines (syllabuses).

Assessment of learning outcomes is carried out using developed test tasks within the educational program in accordance with the requirements of the state compulsory standard of higher and postgraduate education.

When assessing learning outcomes, uniform conditions and equal opportunities are created for students to demonstrate the level of 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»
3	Group of educational programs	6B271 «Oil and gas major»
4	The name of the educational program	6B07214 «Drilling

		engineering»
5	Brief description of the educational program	The educational program «Drilling Engineering» is aimed at training specialists in the field of oil and gas drilling. 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 the principles of drilling technology, mechanics, drilling fluid design, ensuring environmental friendliness and rationality in man-made developments. The subjects of the professional activity of the EP are fields 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. The program focuses on the introduction of innovative and sustainable technologies that take into account the environmental, social and economic aspects of the industry, in accordance with the International Sustainable Development Goals (SDGs).
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	Developers and author:	N. Imansakipova, Doctor of Philosophy, Associate Professor

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														
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	5	**v**	**v**								**v**	

		position on combating corruption as an antisocial phenomenon. Contents: Content: 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												
10	Fundamentals of scientific research methods	Purpose: The goal of studying the discipline is to develop students' research skills; to introduce 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.	5		**v**		**v**							
11	Basics 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:	5	**v**	**v**									**v**	

		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.												
12	Fundamentals of economics and entrepreneurship	The purpose of studying the discipline is to familiarize students with the basic principles of economic theory and entrepreneurial activity. The course includes the study of basic economic concepts, market mechanisms, management tools and key aspects of entrepreneurship, such as starting and managing a business, analyzing the market environment, financial planning, assessing risks and developing development strategies.	5	**v**	**v**								**v**	
13	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,	5	**v**	**v**		**v**						**v**	**v**

		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.												
Cycle of basic disciplines University component														
14	Introduction to major	Purpose: Formation of entry-level knowledge on drilling wells, the basics of well control, selection of drilling tools and familiarization with important standards that are used in drilling. Contents: The discipline covers drilling rig components, simple calculations of drill rig dimensions, descriptions of drilling fluids, principles for selecting drill bits, directional drilling plans and tools that are used for this technology.	4		**v**					**v**				
15	Oil and gas geology	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.	5				**v**	**v**		**v**			**v**	

		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.												
16	Details of cars	Purpose: тhe 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**			
17	Engineering and computer graphics	Purpose: To develop students' knowledge of drawing construction and skills in	5			**v**				**v**	**v**			**v**

		developing graphical and textual design documentation in accordance with standards. Content: Students will study ESKD standards, graphic primitives, geometric constructions, methods 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	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						**v**		**v**			
19	Mathematics II	Purpose: To teach students integration methods. To teach you how to choose the right	5						**v**		**v**			

		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												
20	Fluid mechanics	Purpose: after completing the course, the student must demonstrate the ability to analyze, synthesize and possess the skills of engineering calculations and methods for solving the main problems of the sections of fluid mechanics - kinematics, statics and dynamics. Contents: properties of liquids and gases; - classification of modes and flows of liquid and gas movement; - deformation movement of the elementary volume of the medium; - conservation equations on which the theoretical study of hydromechanics is based.	5			**v**						**v**		**v**
21	General and structural geology	Objectives of the discipline: the study of the material composition of the Earth; Geodynamic	5					**v**		**v**		**v**		**v**

		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, 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.												
22	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 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.	5	**v**		**v**							**v**	
23	Fundamentals of development and operation of oil and gas fields	Purpose: methods of designing the development and operation of oil and gas fields using traditional technology and methods of increasing oil recovery, be able to analyze and regulate development. Contents: - 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	4				**v**					**v**	**v**	**v**

		development design; - methods of analysis and regulation of development.												
24	Rock destruction while drilling wells	Purpose: To convey to students knowledge about the physical and mechanical properties of rocks and methods for studying them, the basic patterns of rock destruction at the bottom of a well, the design of modern rock-cutting tools and coring tools, the principles of their selection in specific mining and geological conditions. Contents: The discipline allows you to competently determine the physical and mechanical properties of rocks, select the most rational rock-cutting tools (drill bits, drill bits) and technical means for taking cores from wells, analyze the phenomena occurring during the formation of a well, and predict the performance of bits and drill bits.	5	v								v		v
25	Strength of materials	Purpose: To teach students integration methods. To teach you how to choose the right method for finding the primitive.Stretching and compression. Pressure in sections and deformations of a direct core. Mechanical properties of materials at a stretching and com-pression. Calculation on	6						v		v			

		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.												
26	Thermodynamics and heat engineering	Purpose: to develop students' theoretical and practical knowledge in the field of thermodynamics and heat transfer. Contents: the discipline covers the basic laws and calculated relationships of thermodynamics and heat transfer, the operating principles of the working processes of heat engines, thermal power plants, refrigeration machines and steam generator plants. The training will allow students to apply this knowledge to solve engineering problems and develop efficient thermal engineering systems.	5	**v**							**v**			
27	Drilling engineering	Purpose: The study of the basic techniques and technological processes of the construction of	5				**v**		**v**		**v**		**v**	

		oil and gas wells, indicators of their efficiency, organization of work and their management, with methods of designing processes, operations, works and analyses of their results. Contents: 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.												
28	Physics I	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	5			**v**			**v**		**v**			

		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.											
29	Physics II	Purpose: to form students' knowledge and skills in using fundamental laws, theories of classical and modern physics, as well as methods of physical research as the basis of a system of professional activity. Contents: harmonic oscillations, damped oscillations, alternating current, wave motion, laws of refraction and reflection of light, quantum optics, laws of thermal radiation, photons, their characteristics, wave function, electrical conductivity of metals, atomic nucleus, its structure and properties, binding energy, radioactivity.	5			v			v		v			
30	Petroleum and gas chemistry	Purpose: formation of knowledge on fundamental issues of general chemistry and skills of their application in professional activity. Chemistry of oil and gas.	5			v			v		v			

		The course examines the theoretical foundations of the chemistry of oil and gas, the physico-chemical properties of hydrocarbon raw materials. The main 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														
31	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 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	6	**v**	**v**								**v**	

		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.												
32	Drilling wells for liquid and gaseous minerals	Purpose: Acquisition of knowledge about the basics of theory, technical means and features of performing technological operations during drilling of oil and gas wells, providing search, exploration and exploitation of deposits. Contents: 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	5	**v**	**v**								**v**	

		drilling wells for liquid and gaseous minerals.												
33	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 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.	5					v				v		v

34	Drilling machines and mechanisms	Purpose: Characterizes modern types of drilling complex equipment, methods of their operation and 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.	5	v			v		v					v
35	Reservoir geomechanics	Purpose: upon completion of the course, the student must demonstrate the ability to analyze, synthesize and design elements of the mining system, as well as assess the impact of drilling, mining and reservoir development technologies on stress distribution in the productive reservoir; how changes in stress values can cause various failures. Contents: - basic concepts of reservoir geomechanics; - calculation of reservoir and geostatic pressures; - destruction of rocks by compression, tension and shear; - calculations for the determination of horizontal stresses, the angle of	5			v	v					v		

		internal friction and the coefficient of friction.												
36	Geosteering	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.	5				v					v	v	
37	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	5			v			v					v

		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, 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.												
38	Offshore deepwater drilling	Purpose: The main goal of studying this discipline is for students to acquire the necessary knowledge and practical skills in designing equipment for drilling wells at sea. Contents: The course " Offshore deepwater drilling" includes topics such as types of offshore platforms, offshore well design, offshore well construction technology, offshore drilling platform equipment,	5	v					v					v

		offshore well operation, offshore well drilling complications.												
39	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, 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			v				v	v			v
40	Fundamentals of the technology of drilling exploration wells	Purposel: providing students with theoretical knowledge and practical skills of drilling methods and technologies for geological exploration, including drilling modes, preparation for research, as well as process optimization and improvement of core yield. Contents: The discipline covers all aspects of drilling operations in geological exploration of mineral resources. The course studies in detail drilling modes, methods of	5				v		v			v		

		constructing and cleaning wells during the drilling process, and also carries out calculations to prepare wells for research. Particular attention is paid to the justification of methods for casing wells and equipping with casing columns. In addition, the course addresses the issues of optimizing exploration drilling and improving core recovery, which is a key component of successful exploration.												
41	Fundamentals of sustainable development and ESG projects in Kazakhstan	Purpose: the goal is for students to master the theoretical foundations and practical skills in the field of sustainable development and ESG, as well as to develop an understanding of the role of these aspects in the modern economic and social development of Kazakhstan. Contents: introduces the principles of sustainable development and the implementation of ESG practices in Kazakhstan, includes the study of national and international standards, analysis of successful ESG projects and strategies for their implementation in enterprises and organizations.	5		**v**		**v**							

42	Legal regulation of intellectual property	Purpose: the goal is to form a holistic understanding of the system of legal regulation of intellectual property, including basic principles, mechanisms for protecting intellectual property rights and features of their implementation. Contents: The discipline covers the basics of IP law, including copyright, patents, trademarks, and industrial designs. Students learn how to protect and manage intellectual property rights, and consider legal disputes and methods for resolving them.	5	v	v								v	
43	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	6						v		v			v

		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.												
Cycle of profile disciplines University component														
44	Drilling fluids	Purpose: providing students with the fundamental knowledge and practical skills necessary to develop and manage drilling fluid programs for well construction. Contents: The discipline includes topics such as classification of drilling fluids, basic technological properties of drilling fluids, the influence of chemical processing and external factors on the properties of drilling fluids, methods for managing properties, choosing the density of drilling fluids, drawing up programs and technological regulations, circulation system, preparation and cleaning drilling fluids.	5			**v**	**v**					**v**		
45	Completion engineering	Purpose: acquisition by students of basic knowledge in the field of the theory of basic technological processes associated with the opening, sampling, development and testing of oil and gas	6	**v**								**v**	**v**	

		deposits, which is necessary for high-quality completion of the construction of oil and gas wells, ensuring environmental safety and economic efficiency. Contents: the discipline examines elements of oilfield geology and physics of oil and gas reservoirs; opening of productive formations and drilling fluids; testing of productive formations in an open hole and casing; secondary opening of productive formations; testing of promising horizons, well development and influx testing.											
46	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	4	**v**		**v**	**v**	**v**			**v**			

		logs, neutron logs, resistivity and density logs, and lithological plots.												
47	Directional drilling	Purpose: to provide students with the necessary knowledge and practical skills for drilling wells, taking into account their inclination relative to the vertical. Content: study of methods of planning, designing and performing inclined drilling, as well as understanding the basic principles and technical aspects related to this process. In addition, the discipline includes the study of various types of equipment used in inclined drilling, and the analysis of practical problems and solutions related to this technology.	5			v						v	v	
48	Well drilling in difficult conditions	Purpose: developing in the student an understanding of the main types of complications, their causes and methods of dealing with them in the process of drilling wells, as well as developing in the student, as a future specialist, a scientific approach to solving problems associated with drilling in difficult conditions. Contents: The discipline covers the basic methods of combating lost circulation, preventing and combating gas, oil and water	5				v		v					v

		manifestations, and accidents during well casing.												
Cycle of profile disciplines Component of choice														
49	Accidents during drilling of exploration and geotechnological wells	Purpose: students obtain knowledge on the basics of methods and technology for drilling geological exploration and geotechnological wells, preventing accidents when drilling these wells. Contents: The main topics of this course are: accidents when drilling wells, the causes of accidents, accidents when casing wells, accidents with downhole motors, accidents with drill bits, falling foreign objects into a well, the procedure for investigating and recording accidents, preventing accidents, preventing emissions and open flowing, emergency response, fishing tools, complications arising during well drilling.	6		**v**			**v**					**v**	
50	Accidents during drilling of oil and gas wells	Purpose: students acquire knowledge and skills in the field of dealing with complications and accidents that may arise during the process of deepening a well into the bowels of the earth. Contents: The discipline teaches the prevention of absorption of liquids in wells, isolation of absorption zones, prevention of	6		**v**			**v**					**v**	

		oil and gas, water shows, drilling in difficult conditions, prevention of accidents during drilling, fishing operations in wells being drilled.												
51	Well Construction Computer Simulation	Purpose: 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. Contents: This course is designed to teach the basics of well planning and drilling workflows on Ansys, Compas software, which includes core topics: reference well analysis, well design, well placement and real-time operations.	4					v		v	v			
52	Well Stimulation	Purpose: to teach students the methods and tools used to monitor and control drilling parameters. Content: the study of technologies for measuring well depth, pressure, temperature, drilling speed, drilling mud parameters and other critical indicators. The course is aimed at developing data analysis and interpretation skills to improve the efficiency and safety of drilling operations	5			v	v				v			v
53	Organization and management of oil and gas production	Purpose: The study of the theoretical basis of processes for	5	v	v		v							

		the organization and management of production at enterprises of the oil and gas industry. Contents: 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.												
54	Fundamentals of Drilling Supervising	Purpose: Formation of theoretical and practical knowledge on drilling technology, including analysis and design of surface and	5	v	v							v		

		deep equipment and tools, as well as methods and techniques for modeling technical and technological parameters of control and management of processes in the well at all stages of its construction. Contents: This course will allow students to acquire fundamental knowledge 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;												
55	Fundamentals of scientific research and optimization in drilling	Purpose: to teach students the methods and tools of scientific research used in the field of drilling Content: the study of modern technologies and approaches to optimizing drilling processes, improving the efficiency and safety of drilling operations, as well as the development and application of innovative solutions to solve complex engineering problems. Within the framework of the discipline, students master the methods of data collection and analysis, modeling and forecasting, which allows them to conduct high-quality scientific	5		**v**		**v**							

		research and implement their results in practice in the oil and gas industry.												
56	Drillind fluids in exploratory drilling	Purpose: Obtaining special knowledge in the field of flushing liquids and grouting mixtures, the technology of their application in the field of well drilling. Contents: 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 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.	5			v	v					v		
57	Petroleum Engineering seminar	Objective: To develop students' general skills and competencies required in research activities, writing scientific research papers, and public presentations, with consideration of inclusive education principles. Content:	5	v	v			v						v

		Based on the study of the course, students will examine: - The formats of high-quality scientific articles and thesis papers, ensuring accessibility for all categories of learners; - The ability to conduct critical analysis of research literature, including works related to inclusive education; - The ability to plan and conduct experiments with an inclusive approach in mind; - Skills for successful presentation of scientific works, considering the adaptation of materials for diverse audiences.												
58	Measuring instruments in drilling	Purpose: to teach students the methods and tools used to monitor and control drilling parameters. Content: the study of technologies for measuring well depth, pressure, temperature, drilling speed, drilling mud parameters and other critical indicators. The course is aimed at developing data analysis and interpretation skills to improve the efficiency and safety of drilling operations	5					v	v	v				
59	Cement slurry systems	Purpose: to study the theoretical and practical aspects of grouting operations used to seal wells in the oil and gas industry. Content: within the framework of the discipline, methods and materials	5			v	v					v		

		used to prevent leaks, ensure mechanical stability and isolate productive formations are considered. The main task is to train specialists who are able to effectively develop and apply grouting solutions that ensure the safety and cost-effectiveness of drilling and operational work												
60	Quality management in drilling	Purpose: training professionals who can effectively manage the quality of drilling operations and develop students' skills in assessing, monitoring and improving the quality of drilling operations, as well as providing an understanding of the standards and requirements necessary to ensure that all drilling processes meet established quality and safety criteria. Contents: the discipline covers theoretical and practical aspects of quality control in drilling operations, including the basics of well qualimetry and quality assessment methods. The course emphasizes quality management methodology, drilling process improvement strategies, and the effectiveness of quality management systems. The program also includes the development, implementation and audit of quality management	4				v							v

		systems, which allows students to carry out conformity assessment and quality control of drilling operations. Emphasis is placed on the practical application of knowledge to improve safety, compliance and productivity of drilling operations.												

5. Curriculum of the educational program

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

SATBAYEV UNIVERSITY

«APPROVED»
Decision of the Academic Council
NPJSC«KazNRTU
named after K.Satbayev»
dated 06.03.2025 Minutes № 10

WORKING CURRICULUM

Academic year	2025-2026 (Autumn, Spring)
Group of educational programs	B271 - "Oil and gas major"
Educational program	6B07214 - "Drilling Engineering"
The awarded academic degree	Bachelor of engineering and technology
Form and duration of study	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																	
HUM137	History of Kazakhstan		GED, RC	5	150	15/0/30	105	GE		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																	
HUM136	Fundamentals of anti-corruption culture and law	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					
CHE656	Ecology and life safety	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								
PHY111	Physics I		BD, UC	5	150	15/15/15	105	E	5								

PHY112	Physics II		BD, UC	5	150	15/15/15	105	E		5							PHY111
MAT102	Mathematics II		BD, UC	5	150	15/0/30	105	E		5							MAT101
M-7. Basic training module																	
PET499	Introduction to major		BD, UC	4	120	15/15/15	75	E	4								
GEN429	Engineering and computer graphics		BD, UC	5	150	15/0/30	105	E	5								
AAP173	Practical training		BD, UC	2				R		2							
GEN443	Strength of materials		BD, UC	6	180	30/15/15	120	E			6						
CHE495	Chemistry		BD, UC	5	150	15/30/0	105	E			5						
GEN416	Details of cars		BD, UC	5	150	30/0/15	105	E			5						
GEO482	General and structural geology		BD, UC	5	150	30/15/0	105	E				5					
PET410	Fluid mechanics		BD, UC	5	150	15/15/15	105	E				5					
CHE559	Petroleum and gas chemistry		BD, UC	5	150	30/15/0	105	E				5					
GEO486	Oil and gas geology		BD, UC	5	150	30/15/0	105	E					5				
PET409	Thermodynamics and heat engineering		BD, UC	5	150	15/0/30	105	E					5				
PET473	Drilling engineering		BD, UC	5	150	30/0/15	105	E					5				
PET474	Rock destruction while drilling wells		BD, UC	5	150	30/0/15	105	E					5				
PET475	Drilling machines and mechanisms	1	BD, CCH	5	150	30/0/15	105	E					5				
PET453	Fundamentals of the technology of drilling exploration wells	1	BD, CCH	5	150	30/0/15	105	E					5				
CSE831	Fundamentals of Artificial Intelligence	1	BD, CCH	5	150	15/0/30	105	E					5				
PET454	Geotiearing	2	BD, CCH	5	150	30/0/15	105	E					5				
PET456	Drilling wells for liquid and gaseous minerals	2	BD, CCH	5	150	30/0/15	105	E					5				
MNG562	Legal regulation of intellectual property	2	BD, CCH	5	150	30/0/15	105	E					5				
PET476	Fundamentals of development and operation of oil and gas fields		BD, UC	4	120	30/15/0	75	E						4			
PET452	Offshore deepwater drilling	1	BD, CCH	5	150	30/0/15	105	E						5			
PET457	Drilling wells for solid minerals	1	BD, CCH	5	150	30/0/15	105	E						5			
MNG563	Fundamentals of sustainable development and ESG projects in Kazakhstan	1	BD, CCH	5	150	30/0/15	105	E						5			
PET501	Reservoir geomechanics	2	BD, CCH	5	150	30/0/15	105	E						5			
PET459	Fluid mechanics in drilling	2	BD, CCH	5	150	30/0/15	105	E						5			
PET461	Reconstruction and workover of wells	1	BD, CCH	6	180	30/15/15	120	E							6		
PET462	Drilling of geotechnological wells	1	BD, CCH	6	180	30/15/15	120	E							6		
CYCLE OF PROFILE DISCIPLINES (PD)																	
M-8. Professional Activity Module																	
AAP102	Production practice I		PD, UC	2				R				2					
PET479	Well logging		PD, UC	4	120	30/15/0	75	E						4			
PET477	Drilling fluids		PD, UC	5	150	30/15/0	105	E						5			
AAP183	Production practice II		PD, UC	3				R						3			
PET460	Quality management in drilling	1	PD, CCH	4	120	30/0/15	75	E						4			
PET483	Well Construction Computer Simulation	1	PD, CCH	4	120	30/15/0	75	E						4			
PET480	Well drilling in difficult conditions		PD, UC	5	150	30/15/0	105	E							5		
PET522	Completion engineering		PD, UC	6	180	30/15/15	120	E							6		
PET464	Cement slurry systems	1	PD, CCH	5	150	30/15/0	105	E							5		
PET465	Measuring instruments in drilling	1	PD, CCH	5	150	30/15/0	105	E							5		
PET470	Accidents during drilling of oil and gas wells	2	PD, CCH	6	180	30/15/15	120	E							6		
PET471	Accidents during drilling of exploration and geotechnological wells	2	PD, CCH	6	180	30/15/15	120	E							6		
PET468	Organization and management of oil and gas production	3	PD, CCH	5	150	30/0/15	105	E							5		

PET469	Drillind fluids in exploratory drilling	3	PD, CCH	5	150	30/15/0	105	E							5		
PET482	Directional drilling		PD, UC	5	150	30/0/15	105	E								5	
AAP195	Predictable Practice		PD, UC	4				R								4	
PET502	Well Stimulation	1	PD, CCH	5	150	30/0/15	105	E								5	
PET478	Fundamentals of Drilling Supervising	1	PD, CCH	5	150	30/0/15	105	E								5	
PET463	Fundamentals of scientific research and optimization in drilling	2	PD, CCH	5	150	30/0/15	105	E								5	
PET503	Petroleum Engineering seminar	2	PD, CCH	5	150	30/15/0	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:									31	29	28	32	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	0	5	56
BD	Cycle of basic disciplines	0	86	26	112
PD	Cycle of profile disciplines	0	34	30	64
Total for theoretical training:		**51**	**120**	**61**	**232**
FA	Final attestation				8
TOTAL:					**240**

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Minutes № 3 dated 28.12.2024

Decision of the Academic Council of the Institute. Minutes № 3 dated 28.11.2024

Signed:

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

Approved:

Vice Provost on academic development — Kalpeyeva Z. E.

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

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

Department Chair - Petroleum Engineering — Akhymbayeva B. .

Representative of the Academic Committee from Employers ____Acknowledged____ — Nysangaliev A.