Institute of «Geology and Oil and Gas Business»

Department of «Petroleum Engineering»

EDUCATIONAL PROGRAM

6B07204 «Petroleum engineering»

Code and classification of the field of education: 6B07 «Engineering, manufacturing and construction industries»
Code and classification of training areas: 6B072 «Manufacturing and processing»
Group of educational programs: B071 «Mining and mineral extraction»
Level on NQF: 6
Level on SQF: 6
Period of study: 4
Volume of credits: 240

Almaty 2024

Educational program 6B07204 «Petroleum engineering» approved at the meeting of the Academic Council of KazNRTU named after K.I.Satpayev.

Protocol no. 12 from 2024 y. "22" 04

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

Protocol no. 06 from 2024 y. "19" 04

Educational program 6B07204 «Petroleum 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:				
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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»	
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Nurkas Zhasulan Bolatzhanuly		Director	LLP «Manul»	
Students:				
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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 "Petroleum Engineering" is devoted to the study, monitoring and management of natural and man-made systems for the extraction of hydrocarbons (oil, associated and natural gas) and other components from the subsurface on the basis of rational subsurface use, including resource-saving, environmentally safe and cost-effective geotechnologies for the development of subsurface resources, systems for the preparation of well products and geological and technical systems for long-term and trouble-free functioning. The program provides for the study of a wide range of subjects from fundamental sciences (mathematics, physics, geology, chemistry) to special disciplines on the development and operation of oil and gas fields, methods of enhanced oil recovery, modeling of technological processes. The subjects of professional activity of the OP are deposits and enterprises engaged in the development and operation of oil and gas fields.

The EP is based on the state educational standard for higher professional education, the professional standard, and the Atlas of New Professions.

The professional standards for this educational program include:

1. Operation of oil and gas wells;
2. Reception, storage and delivery of oil;
3. Commodity transport operations for oil;
4. Oil and gas production management;
5. Commodity production, storage of oil, petroleum products and gas;
6. Commissioning and repair works;
7. Preparation of washing liquids;
8. Heat tracing of oil.

Atlas of new professions – Analytical engineer in the oil and gas industry.

2. Purpose and objectives of the educational program

EP purpose: The purpose of the educational program is to train highly qualified and competitive specialists in the oil and gas industry, competent in the field of development, operation of oil and gas fields, transportation of hydrocarbons and petroleum products.

EP objectives:

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 convey 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 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 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 field of education	6B07 «Engineering, Manufacturing and Civil engineering»
2	Code and classification of direction of personnel training	6B072 «Manufacturing and processing»
3	Group of educational programs	B071 «Mining and mineral extraction»
4	Name of educational program	6B07204 «Petroleum engineering»
5	Brief description of the educational program	The educational program is harmonized with the 6th level of the National Qualifications Framework of the Republic of Kazakhstan, the Dublin Descriptors and contains a wide range of disciplines of fundamental sciences and special disciplines on the development and operation of oil and gas fields, methods of enhanced oil recovery, modeling of technological processes.
6	EP purpose	The purpose of the educational program is to train highly qualified and competitive specialists in the oil and gas industry, competent in the field of development, operation of oil and gas fields, transportation of hydrocarbons and petroleum products.
7	EP type	New EP
8	Level on NQF	6
9	Level on SQF	6
10	Distinctive features of EP	Collaborative EP. Partner OHPE - Pennsylvania State University (PENN STATE), USA
11	List of competencies of the educational program:	1. Apply knowledge of mathematics, science and technology 2. Design and conduct experiments, as well as analyze and interpret data 3. Develop systems, components, or processes to meet desired needs under specific constraints such as economic, environmental, social, political, ethical, health, and safety, production and stability 4. Work effectively in interdisciplinary teams 5. Identify, formulate and solve technical problems 6. Understand professional and ethical responsibility 7. Communicate effectively, be able to formulate thoughts and present projects in public 8. Understand the impact of technical solutions in a global, economic, environmental and social context 9. Understand the need for lifelong learning and self-study 10. Know the current problems of the geological and mining industry,

		be able to analyze and make decisions 11. Use the methods, skills and modern engineering tools necessary for engineering practice
12	Educational program learning outcomes:	ON1. Understand the consequences of technical solutions in the development, operation of oil and gas fields and transportation of hydrocarbons in a global, economic, environmental and social context; ON2. Be able to analyze modern problems and determine the principles of improving the technological processes of the oil and gas industry; ON3. To have understanding of professional and ethical responsibility in the process of working in labor communities; ON4. To have an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice; ON5. To have an ability to effectively communicate; ON6. To have the skills of designing technological processes for the development of oil and gas fields to achieve the tasks set within realistic constraints; ON7. To have apply knowledge of mathematics, science and technology to solve professional problems; ON8. Have lifelong self-learning skills; ON 9. Be able to design and conduct experiments, as well as analyze and interpret experimental data to develop optimal solutions; ON 10. Be able to identify, formulate and solve technical problems in the operation of oil and gas fields; ON11. To have the skills to work in interdisciplinary teams.
13	Form of study	Full-time
14	Period of study	4
15	Volume of the credits	240
16	Language of education	Kazakh, Russian, English
17	Academic degree awarded:	Bachelor of Engineering and Technology
18	Developer and author:	G.Yeligbayeva, Doctor of Chemical Sciences, Professor; Academic Committee

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

№	Name of discipline	Short description of discipline	Amount of credits	The formed educational outcomes										
				ON1	ON 2	ON3	ON 4	ON5	ON6	ON7	ON8	ON9	ON10	ON11
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 technology	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 feelings in the student; teach the student to use the acquired	5				v		v	v	v			

		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 understanding social -political processes, for the formation of political culture, development of a personal position and a clearer	3		**v**				**v**	**v**				

		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 Election Component														
9	Fundamentals of anti-corruption culture and law	Purpose: to increase the public and individual legal awareness and legal culture of students, as well as the formation of a knowledge system and a civic position on combating corruption as an antisocial phenomenon. Contents: Content: improvement of socio-economic relations of the Kazakh society, psychological features of corrupt behavior, formation of an anti-corruption culture, legal	5	v		v		v						v

		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: using in practice all kinds of tools in the field of financial management, saving and increasing savings, competent budget planning, obtaining practical skills in calculating, paying taxes and correctly filling out tax reports, analyzing financial information, orienting in financial products to choose adequate investment strategies.	5	v		v		v						v
12	Fundamentals of economics and entrepreneurship	The purpose of studying the discipline is to familiarize students	5	v		v		v						v

		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.												
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, 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.	5	**v**	**v**	**v**	**v**							**v**
Cycle of basic disciplines University component														
14	Oil and gas well drilling	Purpose: providing fundamental and necessary knowledge of drilling processes, technologies and well construction, covering the operation of equipment and drilling methods. Contents: the	5	**v**	**v**					**v**			**v**	

		discipline covers: a review of drilling work, including various methods and approaches; study of drilling rig components; detailed examination of the drill string and drill bits; reservoir pressure analysis and well control methods; training in well casing techniques, well cementing processes, and features of drilling fluids. The course also includes sections on drilling hydraulics, directional and offshore drilling, allowing students to better understand the specifics and technologies of drilling in various conditions.												
15	Introduction to major	Purpose: The purpose of the subject is to teach students the basics of oil and gas business, to understand the basic technological processes from a scientific point of view and to work at oil and gas production sites. Contents: training in the basics of geology, oil and gas drilling, development and use of oil and gas fields, transportation, storage and processing of oil and gas.	4			**v**		**v**				**v**		
16	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. Natural reservoirs of oil and gas. Deposits of oil and gas. Fields of oil and gas. Geophysical and	5	**v**	**v**			**v**			**v**			

		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.												
17	Well log analysis	Purpose: this class covers basic well logging methods to evaluate important reservoir properties. Among the topics to be discussed are: fundamental rock physics principles, introduction to well logging measurement tools, analysis of open hole logs, porosity determination, formation evaluation of clay-free and shaly sand formations, determination of water saturation. Contents: Archie's equation, net pay thickness, hydrocarbon saturation and recoverable reserves, mud logging principles, density, neutron and sonic logs, resistivity logs, and lithology cross plots.	5		**v**			**v**		**v**		**v**		**v**
18	Engineering and computer graphics	Objective: to form students' knowledge of drawing construction, ability to read, compose and develop graphical and textual design documentation in accordance with the requirements of standards. The student must apply advances in modern computing technology, software to develop skills in making product drawings. Contents: US of DD standards. AutoCAD interface. Graphical primitives. Creation of new layers.	5				**v**			**v**	**v**	**v**		

		Geometric constructions. Methods and properties of orthogonal projection. Monge's epure. Drawing of a point, line and plane on the epure. State Standard 2.305-68. Views. Cuts. Section. Axonometric projections. Basic positional problems. Metric problems. Types of connections. Split connections. Polyhedra. Sketches of parts. Assembly drawing. Detailing. Methods of drawing transformation. Curved lines. Surfaces. Intersecting a surface with a plane. Creating a 3M complex solid object in AutoCAD graphics system. Editing three-dimensional objects.													
19	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**	
20	Mathematics II	Purpose: To teach students integration methods. To teach you how to choose the right method for finding the primitive. To teach how to apply a certain integral to	5								**v**			**v**	

		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_													
21	Mathematics III	Purpose: To teach students integration methods. To teach you how to choose the right method for finding the primitive.The discipline is a continuation of Mathematics II. The course includes sections: ordinary differential equations and elements of probability theory and mathematical statistics. Differential equations with separable variables, homogeneous, in full differentials, linear inhomogeneous differential equations with constant coefficients, systems of linear differential equations with constant coefficients, finding the probability of events, calculating the numerical characteristics of random variables, using statistical methods for processing experimental data are studied.	5								v			v	
22	Fluid mechanics	Purpose: after completing the course, the student must demonstrate the ability to analyze, synthesize and possess the skills of	5				v						v		

		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.												
23	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
24	Revervoir engineering I: Primary recovery	Purpose: study the basic concepts underlying the development of oil fields; demonstrate the application of the material balance method in the development of oil fields; generalize knowledge about reservoir development modes for use in the MB equation; reveal the concept of water inflow into the reservoir; to demonstrate	5	v	v		v		v						

		calculations; familiarize with the basics of immiscible displacement. Content: The course covers calculations of the material balance for natural gas, retrograde condensate, non-volatile (black oil) and volatile (volatile oil) oil systems with and without a gas cap, water pressure regime.												
25	Reservoir Engineering II: Secondary and tertiary recovery	Purpose: develop students' skills to apply analytical and numerical tools to predict incremental oil production. Contents: This discipline covers methods of maintaining reservoir pressure by water injection and gas injection into a gas cap; enhanced oil recovery (EOR) methods such as thermal, gas, chemical and microbiological. Students will also learn about the difficulties and challenges in choosing methods for hydrocarbon production	5	v	v		v		v					
26	Solving the problems of oil and gas engineering	Objective: To develop a comprehensive understanding of problem-solving methods in the petroleum industry, including the fundamental principles and technologies used in drilling, production, development, and transportation, as well as aspects of safety engineering, occupational health, and management. Content: The discipline covers key aspects of technology and techniques in drilling, production, development, and transportation of oil and gas. Students study methods to ensure	4		v		v	v						v

		safety and occupational health, as well as management approaches in the petroleum industry. Special attention is given to analyzing real cases and developing solutions for emerging problems.													
27	Reservoir rock properties	Purpose: familiarizing students with the essence of the basic physical processes in rocks, with the basic petrophysical properties of rocks and their relationships. Contents: Systematic theoretical and laboratory study of the physical properties of formation rocks: lithology, permeability, elastic properties, rock strength, acoustic properties, electrical properties, relative and effective permeability, oil or water saturation, capillary characteristics, interactions between rock and fluid such as adsorption and absorption.	5				v		v					v
28	Revervoir Fluid properties	Purpose: to develop in students a system of theoretical knowledge and practical skills in the field of determining and analyzing the properties of formation fluids, such as oil, gas and formation water, in the conditions of their natural occurrence and during the development of hydrocarbon fields. Contents: the discipline covers the basics of organic chemistry, the study of the phase behavior of hydrocarbon systems,	5						v			v		

		the principles of operation of equations of state, as well as a detailed analysis of five types of reservoir fluids. The course covers dry and wet gas properties, Black oil, including definitions and production data, as well as formation fluid testing techniques. Additionally, the course includes the study of Black oil correlations, equilibrium states of gas and liquid, properties of formation waters and gas hydrates, which provides students with a comprehensive understanding of the physical and chemical properties of formation fluids.													
29	Petroleum Engineering seminar	Purpose: the development of students' general skills and abilities necessary in research, writing research papers, as well as public speaking Contents: based on studying the course, students will consider options for the design of high-quality scientific articles and theses, the ability to conduct a critical analysis of research literature, the ability to plan experiments, as well as the skills of successful presentation of scientific papers	6			v	v	v						
30	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	6							v			v	

		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.													
31	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

32	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 scientific and technical problems of the specialty. Contents: mechanics, dynamics of rotational motion of a solid body, mechanical harmonic waves, fundamentals of molecular-kinetic theory and thermodynamics, transfer phenomena, continuum mechanics, electrostatics, direct current, magnetic field, Maxwell's equations.	5							v		v	v	
33	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	
34	Petroleum and gas chemistry	Purpose: formation of knowledge on fundamental issues of general	5							v		v	v	

		chemistry and skills of their application in professional activity. 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 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 Election Component														
35	Drilling fluids	Purpose: Obtaining basic knowledge in the field of the theory of basic technological processes related to the use of drilling flushing and grouting solutions necessary to ensure environmental safety and economic efficiency of the drilling process. Contents: The discipline allows you to competently choose the type of drilling and cement mortars for specific geological conditions during drilling and completion of wells, determine the	5		**v**				**v**			**v**		

		scope of application of various types of drilling and cement mortars, methods for determining operational properties, develop a solution formulation, experimentally find the composition of the solution for drilling and completion of wells. find a solution with the specified properties, calculate the required amount of materials for the preparation of solutions, select equipment for the preparation, processing, cleaning, degassing of drilling fluids, as well as correctly observe the technology of grouting.												
36	Fundamentals of Artificial Intelligence	Purpose: to familiarize students with the basic concepts, methods and technologies in the field of artificial intelligence: machine learning, computer vision, natural language processing, etc. Contents: general definition of artificial intelligence, intelligent agents, information retrieval and state space exploration, logical agents, architecture of artificial intelligence systems, expert systems, observational learning, statistical learning methods, probabilistic processing of linguistic information, semantic models, natural language processing systems	5				**v**			**v**	**v**	**v**		

37	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						v
38	Design and operation of oil and gas pipelines	Goal: - Mastering the theoretical and practical aspects of the design and operation of pipeline systems for the transportation of liquid and gaseous hydrocarbons. - Formation of skills in performing hydraulic and technological calculations for main pipelines. - Acquisition of knowledge about the classification of pipelines and their main facilities, as well as about the technological processes of pumping oil and gas. - Development of skills in analyzing and optimizing the processes of cleaning, testing, and operation of pipelines, including underwater and underground passages. Content: - Classification of pipelines: types of pipelines, their purpose, design features and main objects of pipeline systems. - Technological processes of oil and gas pumping: the study of the main	5	v	v				v		v			

		technological processes associated with the transportation of hydrocarbons through main pipelines. - Hydraulic calculation of the oil pipeline: methods and principles of hydraulic calculation, determination of flow parameters, calculation of pressure losses. - Calculation of complex pipelines: calculation methods for complex configurations of pipeline systems, analysis and optimization of complex pipelines. - Determination of the optimal frequency of pipeline cleaning: calculation methods and justification of the frequency of cleaning, technology for cleaning the internal surfaces of pipelines. - Pumping of high-viscosity and high-setting oils: features of pumping of high-viscosity and high-setting oils, methods of preventing and eliminating problems. - Conditions of removal of gas and water from main oil pipelines: analysis of conditions and methods of removal of gas and water from main oil pipelines. - Calculation of the bearing capacity of pipelines: basic principles and methods for calculating the bearing capacity of pipelines, assessment of their strength and durability. - Cleaning and testing of pipelines: methods for cleaning the inner cavity of pipelines, procedures and standards for strength and tightness tests. -												

		Underwater crossings of oil pipelines: design and operation of underwater crossings, features of their construction and operation. - Stability of lifting pipelines: analysis and calculation of stability of lifting pipelines, methods of ensuring their reliability. - Calculations of longitudinal displacements of underground pipelines: methods for calculating longitudinal displacements, the influence of temperature and mechanical factors on underground pipelines.												
39	Natural gas engineering	Purpose: after completing the course, the student must demonstrate the ability to analyze, synthesize and design the development of gas and gas condensate fields, as well as calculate the economic indicators of the development of gas and gas condensate fields. Contents: - systems and technological indicators for the development of gas and gas condensate fields; - classification of gas and gas condensate deposits; - features of the development of gas and gas condensate deposits; - physico-chemical methods for the development of gas and gas condensate fields.	5			**v**	**v**		**v**		**v**			
Cycle of profileded disciplines University component														

40	Well completion	Purpose: The main goal of this discipline is to study the technology of drilling oil and gas wells, the design of the drilling mode and bit performance indicators, methods of drilling and sealing objects containing oil and gas, as well as the prevention of complications that arise when drilling a well and opening a productive formation, as well as wells - This is the training of specialists who perform finishing work at a high level. Contents: The discipline teaches students to design a well structure, divide a well section into standard intervals for drilling, select effective well operating parameters and the type of bit, select the type and parameters of the drilling fluid for drilling a well, drill into a productive formation, prevent possible complications when drilling into formations, and use drilling equipment correctly.	4	v		v								v
41	Multidisciplinary petroleum project	Purpose: This course provides a multidisciplinary environment for students to integrate knowledge of geology, geophysics and petroleum engineering to solve real-world problems in the oil and gas industry. Contents: the discipline covers geology, well drilling, methods of developing and operating wells. Students work in teams and, at the end of the course, present the results of their work orally and in writing,	5	v		v	v	v						v

		preparing for writing dissertations/projects.												
42	Oil and gas facilities design and operation	Purpose: The course covers the study of ground structures needed in the oil and gas industry. Contents: pressurized collection system taking into account the size and configuration of the oil field area; separation of oil from gas; main purposes and types of oil and gas separators; calculation of separators taking into account the capacity of gas and liquid; classification of pipelines; prevention of contamination and clogging of pipelines and methods of their purification; oil treatment; oil emulsions and their properties; main methods of destruction of oil emulsions; purposes and types of reservoirs.	6		v				v				v	
43	Corrosion protection of oil and gas equipment	The purpose: is to study in-depth corrosion, anticorrosive protection of equipment for oil and gas production. Contents: Basic concepts and definitions of corrosion processes. Chemical corrosion of metals. Electrochemical corrosion of metals. Corrosive surveys. Insulation coating metal structures. Cathodic protection of underground metal structures. Protector protection of pipelines and tanks. Electro drainage protection of underground pipelines. Inhibitor corrosion.	5			v				v	v	v		
44	Petroleum production engineering	Purpose: formation of a holistic view of the fundamental principles	4	v	v									

		of production engineering, empirical models for production decline curve analysis, and the future performance of natural oil and gas wells. Contents: the discipline some topics include: well completion, artificial lift methods design, sucker rod pumps, gas lift, progressing cavity pumps, electrical submersible pumps, nodal analysis.												
45	Economic evaluation of oil and gas projects	Goal: - Mastering the methods of economic assessment of oil and gas projects, including cash flow analysis. - Acquisition of skills to assess the financial acceptability and attractiveness of proposed projects. - Development of the ability to identify the most attractive projects from the list of acceptable ones based on economic criteria. - Formation of skills to use analytical tools and techniques to make informed decisions in the field of investment analysis and project management in the oil and gas industry Content: the discipline covers: - methods for calculating and estimating cash flows for oil and gas projects, including calculation of net present value (NPV), internal rate of return (IRR), payback period (PP) and profitability index (PI); - assessment of risks and uncertainties; - Capital and operating costs: assessment of	6		**v**	**v**								**v**

		capital costs (CAPEX) and operating costs (OPEX) for oil and gas projects; - economic modeling: building economic models for evaluating oil and gas projects, using specialized software for modeling and analysis. - criteria for the acceptability and attractiveness of projects: determining the criteria for the acceptability of projects, comparing and ranking projects according to their attractiveness based on economic indicators. - financial planning and budgeting: development of financial plans and budgets for oil and gas projects, assessment of their financial stability and profitability.												
Cycle of profileded disciplines Election Component														
46	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	5		v				v			v		

		of horizontal stresses, the angle of internal friction and the coefficient of friction.												
47	Geostatistics	Purpose: The course aims at increasing the understanding of applied geostatistics and focus on concepts and methods important for modelling heterogeneity and uncertainty in reservoir models. Contents: Emphasis is put on work processes for 3D reservoir modelling rather than mathematics and algorithms.	5		v		v		v					
48	Well testing	Purpose: formation of students' knowledge about the basic principles of well test; formation of skills in interpreting well test data and evaluating reservoir parameters. Content: This course covers the study of physical principles, technology of execution and methods of interpretation of the results of modern complex hydrodynamic tests of wells; solving problems of determining the main characteristics of formations to identify the condition and analysis of the bottomhole zone of wells.	5				v					v	v	
49	Well workover	Purpose: To study issues related to the purpose of well repair, is to carry out measures to prevent and eliminate malfunctions of the underground part of the equipment and the borehole. Content: Preparatory: arrival of the crew at the accident site, production of well jamming, placement of equipment at the mouth and	5				v			v			v	

		installation, disassembly of wellhead equipment; Repair work: performing descent operations; Final work: assembly of the wellhead equipment, commissioning of the well, putting it into operation, cleaning of tools and equipment from the resulting contamination, as well as dismantling of equipment and cleaning of the working area.													
50	Well Stimulation	Purpose: 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. Contents: the course includes acidizing and fracturing quality control, conducting the treatment, monitoring pressures, and other critical parameters during and after the treatment.	5		v		v			v		v		
51	Directional drilling	Purpose: teaching students the basics of technology for the construction of inclined wells, well design, scientific understanding of the main technological processes and work in oil production.	5	v					v			v		

		Contents: the acquired knowledge contributes to the formation of the bachelor's skills in directional drilling and operation of oil and gas fields.												
52	Petroleum regulations and practices	Goal: - study of the main aspects of legislation regulating the oil and gas business; - study of legal norms related to the development of private and public mineral rights; - understanding energy policy and legal regulation of oil and gas leases; - - formation of skills for the protection and transfer of rights to oil and gas, as well as leasing management and taxation in the oil and gas industry; - development of the ability to apply legal knowledge to solve practical problems in the field of subsoil use. Content: the discipline contains: - scientific and engineering basis of legislation; - Energy policy; - development of mineral rights; - leasing of oil and gas resources; - taxation in the oil and gas industry; - protection and transfer of oil and gas rights; - regulation of environmental aspects of subsurface use; - International law and subsoil use.	5	**v**	**v**			**v**						
53	Flow assurance	Purpose: students acquire practical skills in solving problems to ensure the uninterrupted flow of oil and gas. Contents: There are many problems when transporting oil and gas through pipelines. These problems require a real understanding of the fundamentals	5				**v**		**v**		**v**			

		of fluid mechanics, heat transfer, phase change, sedimentation and/or obstruction, erosion and new technologies to ensure reliable and cost-effective oil and gas supply.												
54	Development of offshore fields	Purpose: to study the principles of offshore field development, taking into account geological, technical, technological, transport, environmental and regulatory components. The study of types of hydraulic structures and drilling rigs, platforms used under various conditions. Content: The course includes modules considered in the learning process: - - the use of hydraulic structures necessary for exploration and production; - technological trends in the use of all types of wells; - collection and transportation of hydrocarbons and collection systems in the offshore industry.	5		**v**			**v**					**v**	**v**
55	Fundamentals of Data Analytics and Programming for Petroleum Engineers	The purpose of the discipline "Fundamentals of Data Analytics and Programming for Petroleum Engineers" is to equip engineering students with the necessary knowledge and skills in the field of data analytics and programming. This course is designed to develop skills in the use of software tools and data analysis techniques that are used to solve complex engineering problems in the oil and gas industry. Content: The Fundamentals of Data Analytics and Programming for Petroleum	5		**v**					**v**	**v**			

		Engineers course provides students with knowledge and practical skills in the areas of data analysis and programming, tailored to the needs of the oil and gas industry. Key aspects of the course include: Programming Fundamentals: Learn programming in languages such as Python or R, which are widely used for analytical tasks in engineering. Data Analysis: Training in methods for collecting, processing and analyzing large volumes of data, including statistical analysis and machine learning. Applied programming: Development of software solutions for automating engineering calculations, modeling and optimization of processes. Real-life problem solving: Apply learned skills to practical examples and projects related to oil and gas exploration, production and processing. Students learn to process large volumes of data, analyze and interpret them, and use the resulting data to optimize exploration, production and processing processes oil and gas. The course also aims to develop programming skills that will enable engineers to automate calculations, improve design and make manufacturing processes more efficient.												
56	Design and operation of oil and gas storages	Purpose: to develop knowledge and practical skills in the field of	5	v					v		v			v

		design and operation of oil and gas storage facilities. Contents: introduces the principles when choosing sites for the placement of tanks, the classification of oil depots, technical and economic indicators, losses of oil and petroleum products during the operation of tank farms, determining the volume of the tank farm and the choice of types of tanks, types of gas storage facilities, their features during operation												
57	Design and operation of pump and compressor stations	Purpose: to teach future specialists in the design and operation of pumping and compressor stations Content: introduces the development of technological schemes for the installation of structures of buildings of compressor stations, pumping stations, as well as main and auxiliary technological equipment, engineering networks and technological pipelines, ensuring their safe operation and reliability over the standard service life and during construction and reconstruction.	5	v					v		v			v
58	Reservoir Engineering III: reservoir simulation	Purpose: to form students' knowledge of the basics of hydrodynamic modeling of oil and gas reservoirs in the aspect of practical application in professional activities. Contents: This course covers the study of the fundamental principles of modeling oil and gas deposits,	5			v	v		v		v			

		starting with the continuity equation, the Darcy equation, ending with a two-phase two-dimensional reservoir model. Students learn not only to use commercial reservoir modeling software, but also to create their own simple models.												
59	Computer - aided design	Goal: - development of skills in the application of software products for computer-aided design and modeling of technological processes in the oil and gas industry; - formation of scientific and experimental research skills. Content: - software products for CAD; - theorems and similarity criteria; - the method of dimensions; - fundamentals of computer modeling; - modeling of technological processes.	5					v		v	v			
60	Artificial lift systems	Purpose: The purpose of teaching the discipline: The choice and effective use of equipment and pumps in the mechanized method of oil production. Contents: Maintenance and Operation of equipment during oil production; the main requirements for them; the influence and device of rod and rodless pumps; as well as the use and basic calculations during selection. Optimization of pump modes.	5				v		v		v			v
61	Multiphase flow systems	Purpose: Upon completion of the course, the student must demonstrate the ability to analyze, synthesize and design multiphase flow systems in the development	5				v			v			v	

		of oil, gas and gas condensate fields, as well as calculate the economics of the development of oil, gas and gas condensate fields. Contents: - technological indicators for the development of multiphase flow systems for oil, gas and gas condensate fields; - classification of fluid models in the mechanics of liquids and gases; - ways to describe the motion of a continuous medium; - equations of viscous fluid dynamics.												
62	Theory and practice of project management	Purpose: for students to master the basic principles and methods of project management, as well as develop the necessary skills for the successful implementation of projects in various fields of activity. Contents: Students learn the theoretical foundations of project management, including the concepts, principles, methods of planning, organizing, controlling, and completing projects.	5		**v**	**v**								**v**

5. Curriculum of the educational program

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

SATBAYEV UNIVERSITY

APPROVED
Chairman of the Management Board-
Rector of KazNRTU named after K.Satpayev
M. Begentaev
2024 y.

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

Educational program 6B07204 - "Petroleum Engineering"
Group of Educational programs B071 - Mining and extraction of minerals"

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	Foreign language	GED, RC	5	150	0/0/3	105	E	5							
LNG 108	Foreign language	GED, RC	5	150	0/0/3	105	E		5						
LNG 104	Kazakh (Russian) language	GED, RC	5	150	0/0/3	105	E	5							
LNG 104	Kazakh (Russian) language	GED, RC	5	150	0/0/3	105	E		5						
M-2. Module of physical training															
KFK 101-104	Physical Culture	GED, RC	8	240	0/0/8	120	DiffCredit	2	2	2	2				
M-3. Module of information technology															
CSE 677	Information and communication technologies	GED, RC	5	150	2/1/0	105	E			5					
M-4. Socio-cultural development module															
HUM 137	History of Kazakhstan	GED, RC	5	150	1/0/2	105	SE	5							
HUM 132	Philosophy	GED, RC	5	150	1/0/2	105	E			5					
HUM 120	Module of socio-political knowledge (sociology, political science)	GED, RC	3	90	1/0/1	60	E			3					
HUM 134	Module of socio-political knowledge (cultural studies, psychology)		5	150	2/0/1	150	E				5				
M-5. Module on the basis of anti-corruption culture, ecology and life safety															
HUM 136	Fundamentals of anti-corruption culture and law	GED, CCH	5	150	2/0/1	150	E				5				
MNG 489	Fundamentals of economics and entrepreneurship														
PET319	Fundamentals of scientific research methods														
CHE 656	Ecology and life safety														
MNG 564	Basics of Financial Literacy														
CYCLE OF BASIC DISCIPLINES (BD)															
M-6. Module of physical and mathematical training															
MAT 101	Mathematics I	BD, UC	5	150	1/0/2	105	E	5							
PHY 111	Physics I	BD, UC	4	150	1/1/1	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						
MAT 103	Mathematics III	BD, UC	5	150	1/0/2*	105	E			5					
M-7. Basic general technical training module															
GEN 429	Engineering and computer graphics	BD, UC	5	150	1/0/2	105	E		5						
PET484	Introduction to Major	BD, UC	4	120	1/1/1*	75	E	4							
GEO486	Oil and gas geology	BD, UC	5	150	2/1/0*	105	E				5				
GEN443	Strength of materials	BD, UC	6	180	2/1/1*	120	E			6					
CHE495	Chemistry	BD, UC	5	150	1/1/1*	105	E			5					
PET409	Thermodynamics and heat engineering	BD, UC	5	150	1/0/2	105	E				5				
PET410	Fluid mechanics	BD, UC	5	150	2/1/0*	105	E					5			
CHE559	Petroleum and gas chemistry	BD, UC	5	150	2/1/0*	105	E				5				
PET415	Revervoir fluid propeties	BD, UC	5	150	2/1/0*	105	E					5			
PET416	Revervoir engineering I: Primary recovery	BD, UC	5	150	1/0/2	105	E					5			
PET411	Reservoir rock properties	BD, UC	5	150	2/1/0*	105	E					5			
PET424	Well log analysis	BD, UC	5	150	2/1/0*	105	E						5		
PET485	Solving the problems of oil and gas engineering	BD, UC	4	120	1/0/2	75	E						4		
PET486	Petroleum Engineering seminar	BD, UC	6	180	2/1/1*	120	E							6	
AAP173	Educational practice	BD, UC	2						2						
M-8. Petroleum Engineering Basic Training Module															
PET412	Oil and gas well drilling	BD, UC	5	150	2/1/0*	105	E					5			
PET422	Revervoir engineering II: Secondary and tertiary recovery	BD, UC	4	120	1/0/2*	75	E						5		
PET509	Drilling fluids	BD, CCH	5	150	2/0/1	105	E					5			
PET511	Natural gas engineering				2/0/1										
PET510	Design and operation of oil and gas pipelines				1/0/2										
CSE831	Fundamentals of Artificial Intelligence				1/0/2										
MNG562	Legal regulation of intellectual property				2/0/1										

CYCLE OF PROFILE DISCIPLINES (PD)																	
M-9. Petroleum Engineering Professional Activity Module																	
PET487	Well completion	PD, UC	4	120	2/0/1*	75	E						4				
PET488	Petroleum Production Engineering	PD, UC	5	120	1/1/1*	75	E						4				
PET437	Well stimulation	PD, CCH	5	150	2/0/1	105	E						5				
PET428	Design and operation of pump and compressor stations				1/0/2												
PET431	Revervoir engineering III: reservoir simulation				2/0/1												
PET489	Economic evaluation of oil and gas projects	PD, UC	6	180	2/1/1*	120	E							6			
PET500	Oil and gas facilities design and operation	PD, UC	6	180	2/1/1*	120	E							6			
PET432	Directional drilling	PD, CCH	5	120	2/0/1	105	E							5			
PET434	Design and operation of oil and gas storages				1/0/2												
PET439	Artificial lift systems				1/1/1												
PET442	Well testing	PD, CCH	5	150	2/1/0	120	E							5			
PET440	Well workover				2/0/1												
PET430	Computer - aided design				2/0/1												
PET438	Development of offshore fields	PD, CCH	5	150	1/0/2	105	E							5			
PET423	Geostatistica				2/0/1												
PET433	Flow assurance				1/0/2												
PET429	Multiphase flow systems				1/0/2												
PET441	Multidisciplinary petroleum project	PD, UC	5	150	2/1/0*	105	E										5
PET419	Corrosion protection of oil and gas equipment	PD, UC	5	150	2/0/1*	105	E										5
PET417	Petroleum regulations and practices	PD, CCH	5	150	2/0/1	105	E										5
PET421	Reservoir geomechanics				2/0/1												
PET312	Fundamentals of Data Analytics and Programming for Petroleum Engineers				1/1/1												
NSE185	Theory and practice of project management				2/0/1												
AAP102	Production practice I	PD, UC	2	150								2					
AAP183	Production practice II	PD, UC	3	150									3				
AAP195	Predictable Practice	PD, UC	4														4
M-10. Final certification module																	
ECA109	Writing and defense of the thesis / project	FA	8														8
M-11. Additional training module																	
AAP500	Military training	ATT	0														
	Total based on UNIVERSITY:							31	29	31	29	30	30	33	27		
								60		60		60		60			

Number of credits for the entire period of study					
Cycle code	Cycles of disciplines	Credits			
		required component (RC)	university component (UC)	component of choice (CCH)	Total
GED	Cycle of general education disciplines	51		5	56
BD	Cycle of base disciplines		107	5	112
PD	Cycle of profile disciplines		39	25	64
	Total for theoretical training:	*51*	*146*	*35*	*232*
FA	Final attestation	8			8
	TOTAL:	59	146	35	240

Decision of the Academic Council of KazNRTU named after K.Satpayev. Protocol № 12 от "22" 04 2024.

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Protocol № 6 от "19" 04 2024

Decision of the Academic Council of the Institute. Protocol № 12 от "08" 04 2024.

Vice-Rector for Academic Affairs — R.K. Uskenbayeva

Director of the Institute of Geology, Oil and Gas Engineering — A.H. Syzdykov

Department Head Institute of "Petroleum engineering" — G. Zh.Yeligbayeva

Specialty Council representative from employers — N.A. Nysangaliyev