Institute of «Geology Oil and Mining named after K. Turysov»

«Petroleum Engineering» Department

EDUCATIONAL PROGRAM

6B07126 «Transmission networks and infrastructure»

Code and classification of field of education: 6B07 «Engineering, manufacturing and construction industries»
Code and classification of direction of personnel training: 6B071 «Engineering and engineering trades»
Group of educational programs: B165 «Transmission system and infrastructure»
Level on NQF: 6
Level on SQF: 6
Period of study: 4
Volume of the credits: 240

Алматы 2024

Educational program 6B07126 «Transmission networks and infrastructure» 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 6B07126 «Transmission networks and infrastructure» developed by the academic committee in the direction of 6B071 «Engineering and engineering trades».

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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Akhymbaeva Bibinur Serikovna	PhD	Associate Professor	NJSC «Kazakh National Research Technical University named after K.I.Satpayev»	
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Smashov Nurlan Zhaksibekovich	Candidate of Technical Sciences, docent	Associate Professor	NJSC «Kazakh National Research Technical University named after	

			K.I.Satpayev»	
Imansakipova Nurgul Beketovna	PhD	Senior Lecturer	NJSC «Kazakh National Research Technical University named after K.I.Satpayev»	
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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:				
Mahsut Beknur	Student of the educational program 6B07214 «Drilling Engineering»	2nd year (after college)	NJSC «Kazakh National Research Technical University named after K.I.Satpayev»	

Table of contents

List of abbreviations and designations

EP – Educational program
NQF – National Qualifications Framework
IQF – Industry Qualifications Framework
KC – Key competencies
PC – Professional competencies
MIOR – Methods of increasing oil recovery

1. Description of the educational program

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

The EP determines program educational goals, student learning outcomes, 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, discipline content, learning outcomes, and other materials to ensure quality education for students.

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 main pipelines;
2. Oil transportation management;
3. Production technology;
4. Operation and repair of gas distribution pipeline.

2. Purpose and objectives of the educational program

EP purpose: The purpose of the educational program is to train specialists who are in demand in the oil and gas industry, who have the necessary basic competencies in the field of design and operation of main pipelines and oil and gas storage facilities.

EP objectives:

1. Assisting students, teachers and industry experts in understanding the structure of the educational process;
2. Demonstration of the formation of the necessary core competencies after completion of the undergraduate program by students;
3. Establishing a common framework for the feasibility and necessity of the Backbone Networks and Infrastructure training program for all stakeholders, both public and private.

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 construction industries»
2	Code and classification of direction of personnel training	6B071 «Engineering and engineering trades»
3	Group of educational programs	B165 «Transmission system and infrastructure»
4	Name of educational program	6B07126 «Transmission networks and infrastructure»
5	Brief description of the educational program	The educational program (hereinafter, EP) is a set of documents developed by the Kazakh National Research Technical University named after K.I. Satpayev and approved by the Ministry of Education and Science of the Republic of Kazakhstan. The EP takes into account the needs of the labor market, the requirements of economic sectors and is based on the state educational standard for higher professional education in the relevant field. The EP determines program educational goals, student learning outcomes, 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, discipline content, learning outcomes, and other materials to ensure quality education for students.
6	EP purpose	The purpose of the educational program is to train specialists who are in demand in the oil and gas industry, who have the necessary basic competencies in the field of design and operation of main pipelines and oil and gas

		storage facilities.
7	EP type	New EP
8	Level on NQF	6
9	Level on SQF	6
10	Distinctive features of the EP	No
11	List of competencies of the educational program:	1. Is able to apply purposefully basic knowledge in the field of mathematical, natural, humanitarian and economic sciences in professional activities; 2. Able to communicate in business state, Russian and foreign languages; apply the basics of the legal system and legislation of the Republic of Kazakhstan and international experience in the oil and gas field; use the basic patterns and regulatory forms of interpersonal and partnership relations; 3. Is able to apply the achievements of science and technology of the oil and gas industry to solve engineering, environmental and economic problems that have arisen in the course of professional activity; 4. Has the skills to read normative, estimate, design and technical documentation and standards, is able to independently develop technical documentation; 5. Understands the impact of technical solutions in the global, economic, environmental and social context; uses methods, skills and modern engineering tools necessary for professional practice; 6. Is able to combine theory and practice of solving design and engineering problems; is able to independently identify, formulate and solve technical problems; 7. Has basic knowledge in the field of design and operation of oil storage facilities and pipelines, contributing to the formation of a professional with a broad outlook; 8. Is able to use modern equipment, use information technologies in the field of professional activity; 9. Understands modern technical and economic problems; has the skills to independently obtain information about modern engineering achievements and their application in practice; 10. Able to participate in the installation and commissioning during testing and commissioning of new technological equipment. He is able to check the technical condition and the residual resource of technological equipment, to carry out

		equipment diagnostics; 11. Having the skills of designing and conducting experiments, is able to analyze and interpret experimental data.
12	Educational program learning outcomes:	1. Is able to apply purposefully basic knowledge in the field of mathematical, natural, humanitarian and economic sciences in professional activities; 2. Able to communicate in business state, Russian and foreign languages; apply the basics of the legal system and legislation of the Republic of Kazakhstan and international experience in the oil and gas field; use the basic patterns and regulatory forms of interpersonal and partnership relations; 3. Is able to apply the achievements of science and technology of the oil and gas industry to solve engineering, environmental and economic problems that have arisen in the course of professional activity; 4. Has the skills to read normative, estimate, design and technical documentation and standards, is able to independently develop technical documentation; 5. Understands the impact of technical solutions in the global, economic, environmental and social context; uses methods, skills and modern engineering tools necessary for professional practice; 6. Is able to combine theory and practice of solving design and engineering problems; is able to independently identify, formulate and solve technical problems; 7. Has basic knowledge in the field of design and operation of oil storage facilities and pipelines, contributing to the formation of a professional with a broad outlook; 8. Is able to use modern equipment, use information technologies in the field of professional activity; 9. Understands modern technical and economic problems; has the skills to independently obtain information about modern engineering achievements and their application in practice; 10. Able to participate in the installation and commissioning during testing and commissioning of new technological equipment. He is able to check the technical condition and the residual resource of technological equipment, to carry out equipment diagnostics;

		11. Having the skills of designing and conducting experiments, is able to analyze and interpret experimental data.
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	Developers 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										
				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	8				v		v		v		v	v

		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.												
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 historical knowledge in educational, professional and everyday life; evaluate the role of Kazakhstan in world history.	5				**v**		**v**	**v**	**v**			

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 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,	3		**v**				**v**	**v**				

		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 responsibility for acts of corruption in various fields.	5		v			v		v				
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,	5		v					v				

		their readiness and ability to conduct research. Objectives of studying the discipline: to contribute to the deepening and consolidation of existing theoretical knowledge by students; to develop practical skills in conducting scientific research, analyzing the results obtained and developing recommendations; to improve methodological skills in independent work with information sources and appropriate software and hardware.												
11	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				
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	5		v			v		v				

		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						
Cycle of basic disciplines University component														
14	Introduction to major	Purpose: to develop knowledge and practical skills in the field of transportation and storage of oil, gas and petroleum products. Contents: introduction to the basic concepts of petroleum engineering, including pumping of high-viscosity and high-melting oils,	4							v		v		

		natural gas, etc., as well as storage of hydrocarbons through the main pipeline.												
15	Computational fluid dynamics for petroleum engineering	Purpose: developing students' knowledge of the basic principles of computational fluid dynamics; developing the ability to create mathematical models of the flow of liquids and gases inside a pipe. Contents: The discipline teaches analytical and graphical modeling and interpretation of the basic equations of hydro- or gas-dynamics of flows. In addition, the use of various computer programs for mathematical modeling of various liquid and gas flows in a confined space is considered.	5							v	v			
16	Geodesy with the basics of topography	The purpose of the discipline is to study the main tasks of the concept and definition of geodesy, the appearance of the relief, its display on maps and plans, solving the problems of topographic maps and plans, azimuths, directional angles, points, direct and reverse geodetic problems, types and methods of leveling. The discipline studies ways to create new plans for a geodetic network, specialized surveying, an overview of geodetic surveys, general information about plans to support new and high-altitude networks, ways to create a justification for shooting, an image of the earth's surface in a plane.	5						v					v

17	Soil Science and Soil Mechanics	The purpose of the course of teaching the discipline is to familiarize future specialists with the basics of engineering geology, soil mechanics, general provisions of modern methods of calculation, design and construction of foundations, foundations and underground structures. Related to the design, construction and operation of buildings and structures, the installation of underground utilities, laying pipelines. Soil mechanics studies the problems of stress-strain state, strength, deformability and stability of soil massifs and determines the conditions for their use as the foundations of construction objects.	5	v				v				v		
18	Diagnostics and testing of oil and gas facilities	Purpose: Obtaining knowledge, skills and experience in the field of testing technical diagnostics of oil and gas facilities, in order to form the necessary level of professional competencies in the field of technological processes of oil and gas pipelines. Contents: The discipline studies the basic methods and models for diagnosing oil and gas objects. Also considers testing by statistical and dynamic methods in order to assess the characteristics of objects.	6								v	v	v	
19	Engineering geology	The purpose of the course: the acquisition of theoretical	5					v				v		v

		knowledge about the engineering-geological features and properties of rocks, geological and engineering-geological processes occurring in these rocks, engineering-geological conditions of various territories, the study of which is necessary to predict their changes during economic development. Geotechnical properties of rocks. The concept and characteristics of soils. Geological zoning. Methods of engineering and geological research, engineering and geological research for various types of construction. Principles of monitoring exogenous geological processes. Regional Engineering Geology.													
20	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. Geometric constructions. Methods and properties of orthogonal projection. Monge's epure.	5						**v**		**v**		**v**	

		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.													
21	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**			
22	Mathematics II	Purpose: To teach students integration methods. To teach you how to choose the right method for finding the primitive. To teach how to apply a certain integral to solve practical problems. Contents_	5	**v**							**v**			

		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_													
23	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**			
24	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.													
25	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				
26	Fundamentals of budgeting	Purpose: is to train specialists with deep theoretical knowledge and practical skills in the field of design, construction, operation and modernization of oil and gas storage and transportation systems. The course is designed to teach students the principles and methods of ensuring safety,	5		v		v	v						

		efficiency and environmental sustainability when working with oil and gas storage facilities. Contents: studying economic aspects of storage projects, developing project management skills, including planning, budgeting and risk management. This course provides comprehensive knowledge and practical skills necessary for professional work in the field of oil and gas storage design and operation, preparing specialists to meet the current challenges of the industry.													
27	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	
28	Design and operation of oil and gas storage facilities	Purpose: training of specialists capable of solving the tasks of design, construction, operation and maintenance of oil and gas storage facilities. Contents: study of	5								v			v	

		physical and chemical properties of oil and gas, methods of design and calculation of storage facilities, construction and operation technologies, safety and reliability, environmental protection, economic aspects, innovative technologies, and also includes practical calculations and projects. The course is aimed at comprehensive training of specialists for effective management of the processes of creation, operation and modernization of oil and gas storage facilities.													
29	Design of main pipelines	Purpose: training of specialists capable of solving problems of design, construction, operation and repair of pipeline systems for transportation of various substances. It includes formation of theoretical knowledge in hydraulics, thermodynamics, material science and design principles, development of practical skills in hydraulic calculations, flow modeling and development of design documentation, ensuring safety and reliability of systems, taking into account regulatory requirements, as well as economic efficiency and implementation of innovations to optimize costs and improve the reliability of pipelines. Contents: introduction to pipeline	5							v			v	

		transportation, basics of hydraulics and thermodynamics, selection of materials, system design and calculation, construction and operation technologies, diagnostic and repair methods, ensuring safety and reliability, economic aspects and innovative technologies. The course includes practical work and project implementation, which provides comprehensive training of specialists for solving problems related to trunk pipelines.													
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 sections and deformations of a direct core. Mechanical properties of materials at a stretching and com-pression. Calculation on durability and rigidity at a stretching-compression. Geometrical charac-teristics of flat sections. Shift and torsion. Cal-culation on durability and rigidity at torsion. A bend. Normal and tangents of a pressure at a bend. Calculation on durability at a bend. The theory of the intense and deformed conditions. A hypothesis of a limiting condition. Complex resistance. Stability of balance of deformable systems. Dynamic loading.	6	**v**										**v**

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**	

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	
34	Operation of main pipelines	Goal: - Study of the principles and practices of operation of main oil and gas pipelines. - Mastering the methods of organizing the operation of the linear part and pumping stations of main pipelines. - Formation of skills for operational and dispatching management of main pipelines. - Acquisition of knowledge on maintenance and repair of main pipelines. - Understanding the specifics of the operation of main pipelines in various conditions, including extreme and emergency situations Content: - The procedure for the operation of the main oil pipeline: procedures and standards for the operation of oil pipelines, including start-up, monitoring and	4				v							v	

		shutdown. - The procedure for the operation of the main gas pipeline: procedures and standards for the operation of gas pipelines, features of working with high-pressure gas. - Organization of operation of the linear part of the main pipeline: structure and functions of the linear part, monitoring and management methods. - Organization of operation of pumping stations: functions and tasks of pumping stations, methods of increasing the efficiency of their work. - Operational dispatch control of the main pipeline: systems and methods of dispatching control, roles and tasks of dispatchers, use of information technologies. - Maintenance of the main pipeline: planning and carrying out maintenance, diagnostics and prevention of malfunctions. - Repair of the main pipeline: types and methods of repair, organization of repair work, use of modern technologies and materials. - Special operating conditions of the main pipeline: operation in extreme conditions, emergency management, safety and reliability.												
Cycle of basic disciplines Election Component														
35	Fundamentals of Artificial Intelligence	Purpose: to familiarize students with the basic concepts, methods and technologies in the field of	5						**v**		**v**		**v**	

		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.											
36	Fundamentals of rationing and tariff formation	Purpose: to provide undergraduates with practical knowledge and skills necessary to analyze and manage the processes of rationing and tariff setting in the oil and gas industry, taking into account current economic conditions and market requirements. Contents: studying the basic principles and methods of rationing of resource consumption, as well as the processes of setting tariffs for services and products in the field of oil and gas production. Master's students study regulatory and legislative acts governing the activities of oil and gas enterprises, analyze the methods of tariff setting for energy carriers, oil and gas transportation services, as well as other types of services in this industry. The course also examines	5		v		v							

		factors affecting tariff setting, such as economic, social and political aspects.												
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**				
38	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 safety and occupational health, as well as management approaches in the petroleum industry. Special attention is given to analyzing real	5					**v**		**v**				

		cases and developing solutions for emerging problems.												
Cycle of profileded disciplines University component														
39	Engineering calculation approaches in the oil and gas industry	Purpose: Applied engineering tasks are considered in order to form ideas about current trends in industries Contents: This discipline covers the basic methods of statistics, including quantitative and qualitative methods, which are necessary for modeling and designing objects, making engineering, organizational, technological and managerial decisions.	4						**v**		**v**			
40	Management in the design and construction of oil and gas facilities	Purpose: students to master the theoretical foundations and practical skills in the field of design, construction and installation of oil and gas facilities. Content: introduces the principles of sustainable development and the introduction of practices for the formation of the following professional competencies: creation of a process model, construction of an object, selection of contractors, management of contractors' work (design, construction and installation work, production), control and forecast of the processes involved in terms of time, monetary and labor costs and the ratio of the developed business model	5		**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, preparing for writing dissertations/projects.	5			v		v						
42	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.	6	v		v		v						
43	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	4							v	v			v

		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.												
44	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 capital costs (CAPEX) and operating costs (OPEX) for oil and gas projects; - economic modeling: building economic models for	6			**v**	**v**							

		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														
45	Risk analysis	Purpose: the course covers the possible consequences in each specific situation of an effective risk analysis that allows you to identify problems and assess prospects. Contents: deterministic risk analysis "the best, worst and most likely option"; stochastic risk analysis, etc.	5				**v**					**v**		**v**
46	Engineering of oil and gas processing complexes	The purpose: The purpose of this course is the formation of students' skills in the application of analytical and numerical tools for engineering oil and gas processing complexes. Contents: This discipline covers the engineering processes of oil and gas processing complexes and solving problems when choosing methods.	5				**v**	**v**				**v**		

47	Overhaul of pipelines	Purpose: the course covers the study of major pipeline repairs and types of repair work. Contents: Current repairs. Average repair. Major repairs. Diagnostics of main pipelines. Types, their advantages and disadvantages. Organization of operation of the linear part and pumping stations of the main pipeline. Maintenance of the main pipeline. Special operating conditions of the main pipeline. Safety precautions during repair work.	5				v							v	
48	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; -	5		v		v	v							

		regulation of environmental aspects of subsurface use; - International law and subsoil use.													
49	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 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	5									**v**			**v**

		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.												
50	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	5		v	v								
51	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 of oil, gas and gas condensate	5	v										v

		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.													
52	Construction of pipelines	Purpose: the course covers the study of pipeline construction and the procedure for the construction of the main oil pipeline and the main gas pipeline. Content: Organization of the construction of the linear part and pumping stations of the main pipeline. Features of the transitions of main pipelines through artificial and natural barriers. Construction supervision in the construction of the main pipeline. Safety precautions in the construction of main pipelines	5				v							v	
53	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	5			v	v								

		planning, organizing, controlling, and completing projects.													
54	Technical policy	Goal: - Studying the basics of strategic development of organizations and enterprises in the oil and gas industry through the use of research and development (R&D). - Formation of knowledge about the principles of technical regulation and standardization in the operation of main pipelines. - Development of skills in analysis and development of technical policy to ensure efficient and safe operation of pipeline systems. - Preparing students for the application of innovative technologies and techniques to improve the productivity and reliability of oil and gas facilities. Content: - Strategic development of the organization: principles and methods of strategic planning and management. - Research and development work (R&D). - Technical regulation: fundamentals of technical regulation, standardization and certification in the oil and gas industry. - Legal and regulatory support. - Technical policy in the operation of the main pipeline: development and implementation of technical policy, management of technical risks and safety. - Innovative technologies and methods. - Management of	5		v		v			v		v			

		technical projects. - Analysis and optimization of technological processes													
55	Environmental and safety management	Objective: To develop a comprehensive understanding of the principles of environmental management and ecological safety, including environmental regulation, assessment, and expertise, as well as issues of ecological culture and education. Content: The discipline covers key aspects of environmental management and ecological safety, including environmental regulation, ecological assessment and expertise, obtaining environmental permits, and evaluating ecological damage. Students study the principles of ecological culture, education, and awareness, as well as methods to minimize negative impacts on the environment.	5			**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.I.Satbayev
M. Begadilov
2024 y.

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

Educational program 6B07126 - "Transmission networks and infrastructure"
Group of Educational programs B165- "Transmission networks and infrastructure"

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)	Form of control	Allocation of face-to-face training based on courses and semesters							
								I course		II course		III course		IV course	
								1	2	3	4	5	6	7	8
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	Diff.credit	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														
PET519	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	5	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						
PET490	Introduction to Major	BD, UC	4	120	1/1/1	75	E	4							
GIG101	Engineering 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					
CHEE495	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	1/1/1	105	E					5			
MAP113	Geodesy with the basics of topography	BD, UC	5	150	2/1/0	105	E				5				
GEO409	Soil Science and Soil Mechanics	BD, UC	5	150	2/1/0*	105	E					5			
PET178	Computational fluid dynamics for petroleum engineering	BD, UC	5	150	1/1/1	105	E					5			
AAP173	Educational practice	BD, UC	2						2						
M-8. Basic training module for oil and gas transportation and storage															
PET513	Design of main pipelines	BD, UC	5	150	1/0/2	105	E					5			
PET514	Design and operation of pump and compressor stations	BD, UC	5	150	1/0/2	105	E					5			
PET443	Fundamentals of rationing and tariff formation	BD, CCH	5	150	1/0/2	105	E					5			
PET151	Solving the problems of oil and gas				1/1/1										
CSE831	Fundamentals of Artificial Intelligence				1/0/2										
MNG562	Legal regulation of intellectual property				2/0/1										
PET403	Department component	BD, UC	5	150	1/1/1	105	E						5		
PET515	Design and operation of oil and gas storage	BD, UC	5	150	1/0/2	105	E						5		
PET491	Operation of main pipelines	BD, UC	4	120	1/0/2	75	E						4		
PET492	Diagnostics and testing of oil and gas facilities	BD, UC	6	180	2/1/1*	120	E							6	
CYCLE OF PROFILE DISCIPLINES (PD)															
M-9. Oil and gas transportation and storage professional activity module															
PET493	Engineering calculation approaches in the oil and gas industry	PD, UC	4	120	2/0/1	75	E						4		
PET494	Computer - aided design	PD, UC	4	120	1/1/1	75	E						4		
PET516	Environmental and safety management	PD, CCH	5	150	1/0/2	105	E						5		
PET517	Petroleum Engineering seminar				2/1/0										
PET498	Economic evaluation of oil and gas projects	PD, UC	6	180	2/1/1*	120	E							6	
PET495	Corrosion protection of oil and gas equipment	PD, UC	6	180	2/1/1*	120	E							6	
PET447	Technical policy	PD, CCH	5	150	2/0/1	105	E							5	
PET451	Fundamentals of Data Analytics and Programming for Petroleum Engineers				2/0/1										
PET496	Overhaul of pipelines	PD, CCH	5	150	1/0/2	105	E							5	
PET497	Construction of pipelines				1/0/2										
PET450	Engineering of oil and gas processing complexes	PD, CCH	5	150	2/0/1	105	E							5	

	complexes	PD, CCH	5	150		105	E							5	
PET429	Multiphase flow systems				1/0/2										
PET441	Multidisciplinary petroleum project	PD, UC	5	150	2/1/0*	105	E								5
PET518	Management in the design and construction of oil and gas facilities	PD, UC	5	150	1/1/1	105	E								5
PET449	Risk analysis				2/0/1										
PET417	Petroleum regulations and practices				1/1/1										
NSE185	Theory and practice of project management				2/0/1										
AAP102	Production practice I	PD, UC	2								2				
AAP183	Production practice II	PD, UC	3									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 basic 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 "22" 04 2024 y.

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

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

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

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

Head of the "Petroleum Engineering" department — **G.Zh.Yeligbaeva**

Specialty Council representative from employers — **N.A.Nysangaliev**