NCJS «KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY
named after K.I.SATBAYEV»

**Institute of Geology and Oil and Gas Business named after K.Turyssov**

**Department of Petroleum Engineering**

# EDUCATIONAL PROGRAM

## 7M07213 «Petroleum Engineering»

Code and classification of the field of education: 7M07 «Engineering, Manufacturing and Civil engineering»
Code and classification of training areas: 7M072 «Manufacturing and pricessing»
Group of educational programs: M115 «Petroleum Engineering»
Level on NQF: 7
Level on SQF: 7
Period of study: 1
Volume of the credits: 60

**Алматы 2024**

Educational program 7M07213 «Petroleum Engineering» approved at the meeting of the Academic Council of KazNRTU named after K.Satbayev.

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.Satbayev.

Protocol no. 6 from 2024 y. "19" 04.

Educational program 7M07213 «Petroleum Engineering» eveloped by the academic committee in the direction of 7M072 «Manufacturing and pricessing»

| **Full name** | **Academic degree/ academic title** | **Position, course** | **Place of work, contact.** | **Note** |
|---|---|---|---|---|
| **Chairperson of Academic Committee:** | | | | |
| Yeligbayeva Gulzhakhan | Doctor of Chemical Sciences, Professor | Head of the Department | NCJS «Kazakh National Research Technical University named after K.I.Satbayev» | |
| **Teaching staff:** | | | | |
| Gulnaz Moldabayeva | Doctor of Technical Sciences, prof. | Professor | NCJS «Kazakh National Research Technical University named after K.I.Satbayev» | |
| Baimukhametov Murat | Candidate of Physical and Mathematical Sciences, docent | Associate Professor | NCJS «Kazakh National Research Technical University named after K.I.Satbayev» | |
| Akhymbayeva Bibinur | PhD | Associate Professor | NCJS «Kazakh National Research Technical University named after K.I.Satbayev» | |
| Moldabekov Murat | PhD | Associate Professor | NCJS «Kazakh National Research Technical | |

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| | | | University named after K.I.Satbayev» | |
| Smashov Nurlan | Candidate of Technical Sciences, docent | Associate Professor | NCJS «Kazakh National Research Technical University named after K.I.Satbayev» | |
| Imansakipova Nurgul | PhD | Senior Lecturer | NCJS «Kazakh National Research Technical University named after K.I.Satbayev» | |
| Yskak Ardak | PhD | Senior Lecturer | NCJS «Kazakh National Research Technical University named after K.I.Satbayev» | |
| **Employers:** | | | | |
| Nysangaliyev Amangali | 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» | |
| Bekbau Bakbergen | PhD | Leading Researcher, Modeling Service | «KMG Engineering» LLP | |
| Nurkas Zhasulan | | Director | LLP «Manul» | |
| **Students:** | | | | |
| Sadvakasov Mukan | Doctoral student in the educational program 8D07202 – "Petroleum Engineering" | 2nd year | NCJS «Kazakh National Research Technical University named after K.I.Satbayev» | |

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## 1. Description of the educational program

The educational program 7M07213 «Petroleum Engineering» is designed to train specialists in the field of development and operation of oil and gas fields, well drilling, transportation and storage of hydrocarbons.

The curriculum of the 7M07213 «Petroleum Engineering» educational program has been developed taking into account the curricula of the master's degree program of famous research and engineering universities of the world, such as Colorado Schools of Mines, University of Lorraine. The curriculum is fully consistent with current trends in the development of science and technology used in the modern oil and gas industry. The educational program is based on the state educational standard for higher professional education; the professional standard. Atlas of new professions - analytical engineer in the oil and gas industry. The professional standard for this educational program:

1)Operation of oil and gas wells

2)Production management oil and gas production

Undergraduates practice in such companies as «KazMunayGas» JSC, «KMG Engineering» LLP, «QazaqGaz» NC JSC, «Volkovgeologiya» JSC, «SNPS - Ai Dan Munai» JSC, «Kazakh Institute of Oil and Gas» JSC. Under the academic mobility program, undergraduates have the opportunity to complete internships at leading engineering universities in the world.

At all levels of training, teaching is conducted by highly qualified teaching staff, including graduates of universities around the world and the Bolashak program.

Graduates can choose a different career path. They can start working directly as practicing engineers in industry, or they can continue their doctoral studies in petroleum engineering.

The Master's degree program «Petroleum Engineering» is the second level of qualification of the three-level higher education system, it lays the foundation for doctoral programs. The educational program 7M07213 «Petroleum Engineering» was reviewed at a meeting of the Educational and Methodological Council of KazNRTU named after K.I. Satbayev and approved at a meeting of the Academic Council of KazNRTU named after K.I. Satbayev.

## 2. The purpose and objectives of the educational program

**Purpose of the EP:** The purpose of the educational program is the formation of general professional and professional competencies of graduates, instilling general cultural values (competencies of social interaction, self-organization and self-government, system-activity character) necessary for the comprehensive development of personality.

**Objectives of the EP:**

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 undergraduates knowledge of research methodology (setting research goals, collecting data, processing and transforming data, examining data, building models and selecting methods, presenting and visualizing results)

3. Develop the ability to extract the necessary information from various sources, including information flows in real time, analyze it for further decision-making and see logical connections in the system of collected information.

4. To train undergraduates to effectively communicate information and thoughts to other people.

5. To instill in undergraduates the desire for independent learning and the manifestation of a high level of competence in engineering principles and practice.

6. To teach undergraduates 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 the evaluation of learning outcomes of the educational program

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

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

## 4. Passport of the educational program

### 4.1. General information

| № | Field name | Note |
|---|---|---|
| 1 | Code and classification of the field of education: | 7M07 «Engineering, Manufacturing and Civil engineering» |
| 2 | Code and classification of training areas: | 7M072 «Manufacturing and pricessing» |
| 3 | Group of educational programs: | M115 «Petroleum Engineering» |
| 4 | Name of the educational program | 7M07213 «Petroleum Engineering» |

| | | |
|---|---|---|
| 5 | Brief description of the educational program | The educational program «Petroleum Engineering» is devoted to the formation of a knowledge base on the methodology of building concepts, strategies, functional models of activity and interaction, ways of setting and systematically solving tasks and problems in monitoring and managing natural and man-made systems during extraction from the subsoil and transportation of hydrocarbons (oil, associated and natural gas) and other components. It instills management skills, which involves the creation of a strategy for the functioning and development of structures in the oil and gas industry. The subjects of professional activity of the OP are deposits and enterprises engaged in the development and operation of oil and gas fields. |
| 6 | Purpose of the EP | The purpose of the educational program is the formation of general professional and professional competencies of graduates, instilling general cultural values (competencies of social interaction, self-organization and self-government, system-activity character) necessary for the comprehensive development of personality. |
| 7 | EP type | New EP |
| 8 | Level on NQF | 7 |
| 9 | Level on SQF | 7 |
| 10 | Distinctive features of the EP | no |
| 11 | List of competencies of the educational program: | 1.Apply modern knowledge of geology and exploration of MPI in your professional and academic career, design exploration work and provide guidance<br>2.Apply appropriate analysis methods, both qualitative and quantitative, collect and integrate information in the best way and according to the standards of the geological and mining industry.<br>3. Demonstrate the skills of teaching in the bachelor's degree program, working with students, and leading them.<br>4. Conduct independent original research that contributes to the development of geological science and the industry, according to the best practices and standards of the industry. 5. Have communication skills, speak both written and oral language in Russian, Kazakh and foreign languages, professionally and ethically. 6. Have professional knowledge in the field of geological disciplines that contribute to the formation of a highly educated person with a broad outlook and culture; be able to combine theory and practice to solve geological problems |
| 12 | Learning outcomes of the educational program: | 1. To carry out measures to ensure the activities of structural units that contribute to the development of the oil and gas industry, in accordance with the best practices and standards of the industry.<br>2. To apply advanced knowledge of oil and gas engineering in the organization and coordination of work |

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| | | on the oil and gas production site<br>3. To have the skills of professional and ethical communication, both written and oral<br>4. Be able to demonstrate high professional qualities and ethics when interacting with various stakeholders<br>5. To have the skills to apply appropriate methods of analysis, both qualitative and quantitative, to collect and integrate information in the best way and according to the standards of the oil and gas industry<br>6. To have the skills to work with technical documentation and create technical assignments for specific production tasks |
| 13 | Form of training | Full -time |
| 14 | Period of study | 1 |
| 15 | Volume of the credits | 60 |
| 16 | Language of education | Kazakh, Russian |
| 17 | Degree to be conferred | Master of Engineering and Technology |
| 18 | Developer and author: | Doctor of Chemical Sciences, Professor, Yeligbayeva Gulzhakhan and Academic Committee |

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

| № | Name of the discipline | Brief description of the discipline | Number of credits | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|---|---|---|
| **Cycle of general education disciplines<br>Required component** | | | | | | | | | |
| **Cycle of basic disciplines<br>University component** | | | | | | | | | |
| 1 | Foreign language (professional) | The purpose of the course is to improve and develop foreign language communication skills in the professional and academic field. Course content: general principles of professional and academic intercultural oral and written communication using modern pedagogical technologies (round table, debates, discussions, analysis of professionally oriented cases, design). | 2 | | | v | v | | |
| 2 | Management | The purpose of the discipline is the formation of a scientific understanding of management as a form of professional activity; mastering the general theoretical provisions of the management of socio-economic systems by students; mastering the skills and abilities of practical solution of managerial problems; studying the world experience of management, as well as the peculiarities of Kazakhstani management, training in solving practical issues related to the management of various aspects of the activities of organizations. | 2 | | | v | | | v |

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| 3 | Psychology of management | Objective: To acquire skills in making strategic and managerial decisions, taking into account the psychological characteristics of the individual and the team. Content: the modern role and content of psychological aspects in management activities, methods for improving psychological literacy, the composition and structure of management activities, both at the local and foreign levels, the psychological feature of modern managers. | 2 | | | v | | | v |
| **Cycle of basic disciplines**<br><br>**Component of choice** | | | | | | | | | |
| 1 | Principles of designing oil and gas storages | Objective: To master the principles of designing oil and gas storage facilities, methods and concepts of visual representation of spatial data obtained as a result of measurements for making managerial and engineering decisions. Content: as a result of studying the subject, the undergraduate must master - underground and surface reservoirs; the foundation and foundation of reservoirs, the classification of oil depots, the main structures of oil depots, gas storage facilities, features of storage of liquefied petroleum gases | 4 | | | | v | v | |
| 2 | Principles of Reservoir engineering | Purpose: To study the basic principles underlying the development of oil and gas fields, the application of the material | 4 | v | v | | | v | |

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| | | balance method in the development of these fields, we will study various modes of deposit development for their application in the material balance equation. The concept of water inflow into the reservoir will also be considered. We will perform calculations to predict oil and gas production from fields, as well as to predict reservoir pressure and production from oil and gas wells. Content: This course covers the key concepts required for the development of oil and gas fields. We will study methods for calculating initial hydrocarbon reserves, as well as analyze changes in pressure and temperature in deposits depending on depth. Let's consider the natural processes of oil displacement, as well as draw a material balance for saturated and unsaturated oils. In addition, we will study the parameters of wells based on hydrodynamic studies, determine the PVT properties of reservoir fluids and rocks, analyze the results of oil field development, perform calculations of water inflow into the reservoir and forecast oil production during water injection and other aspects. | | | | | | | |
| 3 | Advanced Thermodynamics and Phase Behavior of Reservoir Fluids | Purpose: is an in-depth study of thermodynamic principles and their application in technological processes of oil and gas production. Contents: the discipline covers the laws of thermodynamics in technological | 4 | v | v | | | | |

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| | | processes of oil and gas production. Thermophysical properties of sedimentary rocks. Thermophysical properties of formation fluids of natural origin. Components of formation fluids. Students will gain the knowledge necessary to analyze and optimize hydrocarbon production processes. | | | | | | | |
| **Cycle of profile disciplines**<br><br>**University component** | | | | | | | | | |
| 1 | Research seminar for petroleum graduates | Purpose: formation of the scientific base in research, analysis and formation of results, including literary research, planning and publication of scientific research. Content: the discipline defines the general methodology of scientific research, as well as methods of obtaining theoretical, experimental and experimental works in the oil and gas industry. | 5 | | | **v** | **v** | **v** | |

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| | Corrosion of main pipelines and oil and gas storage facilities | The purpose: The discipline studies the main provisions of the theory of corrosion of metals and alloys, the analysis of factors affecting corrosion. Contents: Corrosion of main pipe-lines and oil and gas storage facilities and considers corrosion inhibitors. The course outlines the theoretical foundations of chemical (gas) and electrochemi-cal corrosion, examines various types of corrosion, gives the corrosion charac-teristics of metals used for main pipelines and oil and gas storage facilities, and provides methods for their protection. Special attention is paid to the skill of choosing a corrosion-resistant material for a specific production equipment during the storage and transportation of oil and gas using the theoretical mate-rial of this course. | 4 | **v** | **v** | | | **v** | |
| 2 | Theory of motion of gas-liquid mixtures | Purpose: the study of the distinctive features of gas-liquid mixtures, structures and forms of movement of gas-liquid mixtures, criteria for the allocation of structures and forms of gas-liquid flows, energy balance in the well. Contents: investigation of the constrained movement of gas bubbles in a stationary liquid; structures, forms of movement of gas-liquid mixtures and criteria for their separation; the physical essence of the liquid lifting process; equation of motion of the mixture in long lifts. Methods are considered that allow analyzing, synthesizing and designing the operation of | 5 | **v** | | | **v** | **v** | |

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| | | ideal and semi-ideal lifts; the operation of the lift in various modes, as well as calculating costs. | | | | | | | |
| 3 | Production practice | The Production practice is conducted in order to consolidate the theoretical knowledge gained in the learning process, acquire practical skills, competencies and professional experience in the Master's degree program being taught, as well as to master best practices. | 9 | | | v | | | v |
| **Cycle of profile disciplines<br>Component of choice** | | | | | | | | | |
| 1 | Methods to improve the efficiency of oil and gas pipelines | Purpose: To form knowledge and practical skills in the field of operation of gas and oil pipelines to solve scientific and technical problems of their safe operation. Content: as a result of studying the subject, the undergraduate must master theoretical and practical skills in improving the efficiency of gas and oil pipelines, the main issues of pipeline transport of liquid and gaseous hydrocarbons are considered, the essence of technological processes related to pumping oil and gas through main pipelines is given | 5 | | | | | v | v |
| 2 | Petroleum Reservoir Simulation: Black -oil model | The purpose of the discipline "Reservoir Modeling: Black-oil model" is to teach students the basics and methods of numerical modeling of oil and gas reservoirs using a simplified Black-oil model. The course is aimed at developing students nts skills in using mathematical and computer technologies to analyze and | 5 | v | | | v | v | |

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| | | predict the behavior of the reservoir during field development. Students study the fundamental physical and chemical processes that occur in the reservoir, and also master modeling techniques that optimize the production and management of oil and gas reservoirs. Content: The Reservoir Modeling: Black-oil Model course covers the fundamentals of using the Black-oil model to model the behavior of oil and gas reservoirs. Students learn: Fundamentals of the Black-oil model, including the physical and chemical properties of oil, gas and water. Mathematical description of reservoir processes, such as flow and mass conservation equations for each phase. Application of numerical methods to solve model equations, including finite difference and volume methods. Analysis of modeling results to optimize field development and production management. | | | | | | | |
| 4 | Design of pumping and compressor stations | Purpose: To form knowledge and practical skills in the field of optimizing the operation of pumping and compressor stations to solve scientific and technical problems for their safe operation. Content: as a result of studying the subject, the undergraduate must master theoretical and practical skills in determining the main technical indicators of pumping and compressor units, regulating the operation of pumping and compressor units in | 5 | | | | **v** | **v** | |

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| | | different situations, taking into account their characteristics, management and operation of basic and auxiliary equipment. | | | | | | | |
| 7 | Project Management | Goal: Gaining knowledge about the components and methods of project management based on modern models and standards. Objectives: study of behavioral models of project-oriented management of business development; mastering international standards PMI PMBOK, IPMA ICB and national standards of the Republic of Kazakhstan in the field of project management; analysis of the features of organizational management of business development through the integration of strategic, project and operational management. | 5 | | | | **v** | | **v** |

# 5. Curriculum of the educational program

SATBAYEV UNIVERSITY

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

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

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

**Educational program 7M07213 - "Petroleum engineering"**
**Group of educational programs M115 - "Petroleum engineering"**

**Form of study: full-time** | **Duration of study: 1 year** | **Academic degree: master 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 | Form of control | Allocation of face-to-face training based on Icourse | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 1 semester | 2 semester |
| **CYCLE OF BASIC DISCIPLINES (BD)** | | | | | | | | | |
| **M-1. Module of basic training (university component)** | | | | | | | | | |
| LNG212 | Foreign language (professional) | BD, UC | 2 | 60 | 0/0/2 | 30 | E | 2 | |
| MNG726 | Management | BD, UC | 2 | 60 | 1/0/1 | 30 | E | 2 | |
| HUM211 | Management Psychology | BD, UC | 2 | 60 | 1/0/1 | 30 | E | 2 | |
| **M-2. Petroleum Engineering Basic Training Module** | | | | | | | | | |
| PET274 | Advanced Thermodynamics and Phase Behavior of Reservoir Fluids | BD, CCH | 4 | 120 | 2/0/1 | 75 | E | 4 | |
| PET275 | Principles of designing oil and gas storages | | | 120 | 2/0/0 | 75 | E | | |
| PET276 | Principles of Reservoir engineering | | | | | | | | |
| **CYCLE OF PROFILE DISCIPLINES (PD)** | | | | | | | | | |
| **M-3. Petroleum Engineering Professional Activity Module** | | | | | | | | | |
| PET266 | Theory of motion of gas-liquid mixtures | PD, UC | 5 | 150 | 2/0/1 | 105 | E | 5 | |
| PET263 | Research seminar for petroleum graduates | PD, UC | 5 | 150 | 2/0/1 | 105 | E | 5 | |
| PET222 | Advanced Production Engineering | PD, CCH | 5 | 150 | 2/0/1 | 105 | E | 5 | |
| PET216 | Petroleum Reservoir Simulation: Black-Oil Model | | | 150 | 2/0/1 | 105 | | | |
| PET265 | Methods to improve the efficiency of oil and gas pipelines | | | 150 | 2/0/1 | 105 | | | |
| PET211 | Petroleum Reservoir Simulation: Compositional model | PD, CCH | 5 | 150 | 2/0/1 | 105 | E | 5 | |
| PET248 | Advanced Drilling Fluids | | | 150 | 2/0/1 | 105 | | | |
| PET224 | Design of pumping and compressor stations | | | 150 | 2/0/1 | 105 | | | |
| MNG705 | Project Management | | | 150 | 2/0/1 | 105 | | | |
| PET271 | Corrosion of main pipelines and oil and gas storage facilities | PD, UC | 4 | 120 | 2/0/1 | 105 | E | | 4 |
| **M-4. Practice-oriented module** | | | | | | | | | |
| AAP253 | Production practice | PD, UC | 5 | | | | | | 5 |
| **M-5.Experimental research module** | | | | | | | | | |
| AAP257 | Experimental research work of a master student, including an internship and the implementation of a master's project | ERWM UC | 13 | | | | | | 13 |
| **M-6. Module of final attestation** | | | | | | | | | |
| ECA213 | Design and defense of the master's project | FA | 8 | | | | | | 8 |
| | **Total based on UNIVERSITY:** | | | | | | | 30 | 30 |
| | | | | | | | | 60 | |

**Number of credits for the entire period of study**

| Cycle code | Cycles of disciplines | Credits | | | |
|---|---|---|---|---|---|
| | | | university component (UC) | component of choice (CCH) | Total |
| BD | Cycle of basic disciplines | | 6 | 4 | 10 |
| PD | Cycle of profile disciplines | | 19 | 10 | 29 |
| | *Total for theoretical training:* | *0* | *25* | *14* | *39* |
| | ERWM | | | | *13* |
| FA | Final attestation | 8 | | | 8 |
| | TOTAL: | 8 | 25 | 14 | 60 |

Decision of the Academic Council of Kaznu named after K.Satpayev. Protocol № 12. 22.04. 2024 y.

Decision of the Educational and Methodological Council of Kaznu named after K.Satpayev. Protocol № 6 19.04. 2024

Decision of the Academic Council of the Institute_____. Protocol № 12 от "08" 10 2024 y.

| | |
|---|---|
| **Vice-Rector for Academic Affairs** | **R.K. Uskenbayeva** |
| **Institute Director** | **A.H. Syzdykov** |
| **Department Head** | **G. Zh.Yeligbayeva** |
| **Specialty Council from employers** | **N.A. Nysangaliyev** |