

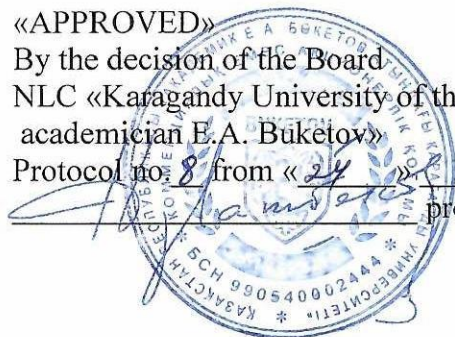
**Ministry of Science and Higher Education of Republic of Kazakhstan
Karaganda University of the name of academician E.A. Buketov**

«APPROVED»

By the decision of the Board
NLC «Karagandy University of the name of
academician E.A. Buketov»

Protocol no. 8 from «24» 05 2024 y.

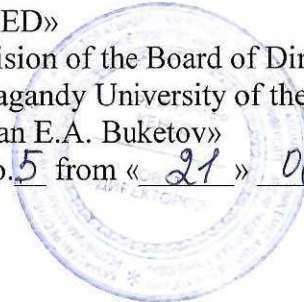
prof. N.O.Dulatbekov.



«APPROVED»

By the decision of the Board of Directors of
NLC «Karagandy University of the name of
academician E.A. Buketov»

Protocol no. 5 from «21» 06 2024 y.



EDUCATIONAL PROGRAM

7M07103 - Petrochemistry

Level: Master's

Karaganda
2024

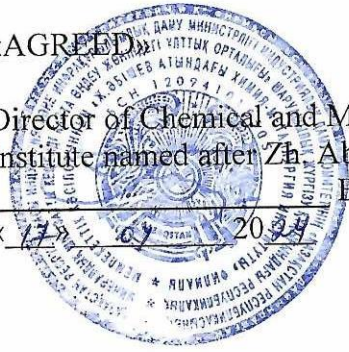
APPROVAL SHEET

EDUCATIONAL PROGRAM «7M07103-Petrochemistry»

«AGREED»

Director of Chemical and Metallurgical
Institute named after Zh. Abishev
Baysanov S.O.

« 17 / 07 / 2024 »



APPROVAL SHEET

EDUCATIONAL PROGRAM «7M07103-Petrochemistry»

«AGREED»

General Director of JSC "Shubarkol Komir"
Sergey Kim

« 14 » 09 2024



Educational program in the direction of training "7M071-Engineering" developed on the basis of:

- Law of the Republic of Kazakhstan dated July 27, 2007 No. 319-III "On Education"
- Law of the Republic of Kazakhstan dated July 11, 1997 No. 151-I. "On languages in the Republic of Kazakhstan"
- State obligatory standard of postgraduate education dated August 31, 2018 No. 604
- The National Qualifications Framework of March 16, 2016 by the Republican Tripartite Commission on Social Partnership and Regulation of Social and Labor Relations.
- Order of the Ministry of Education and Science of the Republic of Kazakhstan "On approval of the Rules for organizing the educational process on credit technology" dated October 2, 2018 No. 152 (as amended and supplemented on October 12, 2018 No. 563)
- Classifier of areas for training personnel with higher and postgraduate education dated October 13, 2018. No. 569.
- Professional standard "Science (scientific, scientific and technical activities)", "Higher and postgraduate education (pedagogical and methodological activities)" (Approved by the Letter of the Ministry of Health and Social Development of July 10, 2015 No. 10-3-16 / 14215)
- Sectoral Qualifications Framework "Chemical Production" (Approved by the minutes of the Meeting of Industry Commissions on Social Partnership and Regulation of Social and Labor Relations for the Mining and Metallurgical, Chemical, Construction and Woodworking, Light Industry and Mechanical Engineering of August 16, 2016 No. 1

Content

№	Passport of the educational program (hereinafter - EP)	Pages
1	Code and name of the educational program	4
2	Code and classification of the field of education, areas of training	4
3	Group of educational programs	4
4	Volume of loans	4
5	Form of training	4
6	Language of instruction	4
7	Degree awarded	4
8	Type of EP	4
9	Level of MCKO	4
10	Level of HPK	4
11	Level of OPK	4
12	Distinctive features of the EP	4
	Partner University (SOP)	4
	Partner University (DDOP)	4
13	The number of the appendix to the license for the direction of training	4
14	The name of the accreditation body and the validity period of the accreditation	4
15	Purpose of the EP	4
16	Qualification characteristics of the graduate	4
a)	List of graduate positions	4
б)	Scope and objects of professional activity of the graduate	4
в)	Types of professional activity of the graduate	5
г)	Functions of the graduate's professional activity	5
17	Formulation of learning outcomes based on competencies	7
18	Determination of modules of disciplines in accordance with the results of training	9
19	Matrix of achievability of learning outcomes	10
20	Coordination of the planned learning outcomes with the methods of teaching and evaluation within the module	15
21	Graduate Model	17

1. **Code and name of the educational program:** 7M07103-Petrochemistry
2. **Code and classification of the field of education, areas of training:** 7M071 Engineering
3. **Group of educational programs:** 7M071 Engineering
4. **Volume of credits:** 120
5. **Form of study:** full-time
6. **Language of instruction:** Russian
7. **Degree awarded:** Master of Technical Sciences in the educational program "7M07103- Petrochemistry".
8. **Type of OP:** valid
9. **MCKO level** – Level 7
10. **Level of HPK**– Level 7
11. **Level of OPK**– Level 7
12. **Distinctive features of the EP:**
Partner University (SOP):no
Partner University (DDOP): no
13. **The number of the appendix to the license for the direction of training:**KZ83LAA00018495 (016) from 07.28.2020
14. **The name of the accreditation body and the validity period of accreditation:** NCAOKO Agency. Accreditation of the SAA OP No. 0174/5 certificate. date of issue: from 23.12.2019 to 20.12.2024.
15. **The purpose of the OP:** training of qualified specialists with practical and theoretical knowledge in the field of future professional activity, based on international standards of postgraduate engineering education, ensuring their competitiveness.
16. **Qualification characteristics of the graduate:**
 - a) **A list of graduate positions.** Qualifications and positions are determined in accordance with the National Classifier of the Republic of Kazakhstan "Classifier of Occupations" of the Tax Code of the Republic of Kazakhstan 01-2017 (approved and put into effect by the Order of the Committee for Technical Regulation and Metrology of the Ministry of Investment and Development of the Republic of Kazakhstan dated May 11, 2017 No. 130-od). Including:
 - technologist.
 - chemical technologist.
 - marketer of inorganic production.
 - master technologist.
 - specialist in the departments of the university in the profile.
 - teacher of secondary educational institutions
 - b) **The scope and objects of professional activity of the graduate.** The sphere of professional activity of graduates of the educational program "7M07103-Petrochemistry" are:
 - enterprises producing petrochemical and organic substances, polymers, elastomers, motor and rocket fuels;
 - oil, gas and coal processing enterprises;
 - enterprises for the extraction, preparation and transportation of hydrocarbon raw materials and their rational use;

- defense enterprises;
- mining industries;
- research and design branch institutes;
- secondary technical and higher educational institutions;
- departments of chemical and special profile.

c) Types of professional activity of the graduate:

- petrochemical and oil refining industry;
- production and processing of polymers;
- food industry;
- science and education.

d) The functions of the graduate's professional activity a graduate of the OP "7M07103-Petrochemistry" carries out his professional activity, depending on the sphere and objects, in the following directions:

- training of young people in chemistry and technology of processing organic substances;
- education of the younger generation in pedagogical and industrial activities;
- creation of friendly relations in a professional environment;
- development of international cooperation in professional activities.

Production and technological activities:

- organization of the work of the team in the conditions of the current production;
- evaluation of the composition and properties of the feedstock in order to be able to develop new technological processes that ensure high

quality:

- analysis of ways to improve and modernize technological lines, equipment in order to conduct highly efficient technological processes for the production and processing of organic substances;
- conducting a technical and economic analysis of production.

Organizational and managerial activities:

- organization and implementation of input control of raw materials from the standpoint of the possibility of production and processing of organic substances:

- implementation of technical control:

Settlement and design activities:

- design of new and modernization of existing technological schemes, selection of technological parameters, calculation of equipment selection;
- development of design and estimate documentation that ensures the effectiveness of design solutions;
- analysis and evaluation of alternative variants of the technological scheme and individual nodes based on the widespread use of mathematical models.

Research activities:

- planning and conducting scientific research in the field of chemical technology of organic substances, in the field of organic and petrochemical synthesis, as well as production and processing of coal and gas:

- creation, modeling and optimization of production facilities and technological schemes, solving technological problems;
- analysis of current trends in the development of chemical technology in various industries.

Formulation of learning outcomes based on competencies

Type of competencies	Learning result code	Learning result (according to Bloom's taxonomy)
1. Behavioral skills and personal qualities (Softskills)	SR1	Able to assess situations in various areas of interpersonal, social and professional communication, taking into account basic knowledge of history, philosophy of science using the methods of scientific and philosophical knowledge
	SR2	Applies knowledge of the state and at least one of the foreign languages at the level of reading technical literature and speaking skills in their professional activities
	SR3	Uses innovative methods when conducting various types of classes in technological disciplines in pedagogical activity
	SR4	Able to be flexible and mobile in various conditions and situations related to professional activities
2 Digital competencies (Digital skills)	SR5	Applies modern information and communication technologies in the research, development and production of petrochemical and coal-chemical substances
	SR6	Conducts selection and systematically combines knowledge of scientific problems of chemistry and chemical engineering, methods of scientific research in engineering systems and uses them in specific situations
	SR7	Owns the methods of setting up an experiment to solve complex problems of petrochemistry and chemical engineering, plans and conducts chemical and technological experiments
	SR8	Able to conduct and operate a production line, takes part in the development and modernization of technological schemes for the production of petroleum products, coal substances and methods for the disposal of polymeric materials and plastics
	SR9	Able to perform work in the field of scientific and technical activities in design, information services, organization of production, labor and management, metrological support, technical control and commercialization of the results obtained
3. Professional competencies (Hard skills)	SR10	Conducts an examination of technical documentation, supervision and control over the condition and operation of technological equipment, identifies reserves, establishes the causes of existing shortcomings and malfunctions in work, takes measures to eliminate them and increase the efficiency of production processes
	SR11	Uses the skills to apply knowledge of the fundamental laws of chemistry, chemical technology, catalysis and thermal processes to solve research problems in the subject area
	SR12	Applies experimental and theoretical methods for the analytical determination of chemicals and uses spectral apparatus, and is aware of the sensitivity and resolution of the analytical method
	SR13	Selects and applies experimental and computational-theoretical research methods in professional activities, knows how to interpret and correctly evaluate experimental data, identify substances
	SR14	Shows skills in searching for information from all types of scientific and technical documentation, including scientific reports, reviews, reports and articles

Determination of modules of disciplines in accordance with the results of training

Learning result code	Name of the module	Name of disciplines	Volume (ECTS)	
SR1, SR4	Philosophical and historical aspects of socio-humanitarian knowledge	History and philosophy of science	4	
SR2, SR3		Higher School Pedagogy	4	
SR1, SR7		Psychology of management	4	
SR3, SR13		Teaching practice	4	
SR1, SR2	Professional Languages	Foreign language (professional)	4	
SR4, SR10		Thermal processes in petrochemistry	5	
SR1, SR2		Reading and translation of English scientific literature		
SR8, SR9	Calculations in petrochemical technology	Commercialization of the results of scientific and technical activities	5	
SR5, SR12		Calculations in the design of petrochemical plants		
SR6, SR10		Actual problems of cavitation processing of heavy hydrocarbon raw materials	5	
SR4, SR9		Petrochemistry and ecology		
SR3, SR11	Petrochemistry and oil refining	Selectivity and stereospecificity of catalysts in petrochemistry	6	
SR5, SR6		Technology of heterolytic and homolytic refining processes	4	
SR6, SR9, SR11		Technology for processing heavy hydrocarbons	4	
SR4, SR6, SR11	Technology fuels and oils	Spectral methods in petrochemistry	4	
SR4, SR10, SR11		Chromatographic methods of hydrocarbon analysis		
SR1, SR4		Petrochemistry (english)	5	
SR4, SR7, SR10		Separation of aromatic hydrocarbons from reforming		
SR4, SR11		Inorganic substances in oils	5	
SR2, SR6, SR12		Theoretical bases of oil refining		
SR4, SR7, SR11		Production of greases	5	
SR4, SR10, SR11		New polymer materials for the petrochemical industry		
SR1, SR6, SR9		Petrochemical industry modeling	6	
SR8, SR9, SR12		Design development of oil refining enterprises		
		Research work	Research	14
			Undergraduate	24
		Final certification	Registration and defense of a master	8

	Petrochemistry and ecology	It is studied in order to form knowledge about the elemental composition, hydrocarbon and non-hydrocarbon components, physical and chemical properties of oil and oil products, the main environmental problems of oil production, oil refining and petrochemistry. The course is designed to develop the skills of chemical analysis of oil and oil products.	5											
D8	Selectivity and stereospecificity of catalysts in petrochemistry	Каталитикалық крекинг және риформинг процесін басқару негіздері. Каталитикалық крекинг және риформинг процесінің реакторлары мен регенераторларының түрлері. Мұнайдың пайда болу теориясы, мұнай және мұнайонімдерінің химиялық құрамы, мұнай және мұнай онімдерінің физикалық қасиеттері. Мұнай-химиялық синтез негіздері туралы жалпы мәліметтер.	6											
D9	Technology of heterolytic and homolytic refining processes	It is studied in order to form knowledge about the fundamentals and theories of catalysis: kinetics; heterolytic processes: catalytic cracking, alkylation, polymerization; homolytic processes; production of hydrogen, synthesis of methanol, elemental sulfur; hydrocatalytic: hydrotreatment, hydrodesulfurization, hydrocracking, reforming, isomerization, hydrodearomatization, hydrodewaxing; poisoning, regeneration and production of catalysts.	4											
D10	Technology for processing heavy hydrocarbons	It is studied in order to form knowledge about heavy hydrocarbon raw materials: elemental and component composition, classification, modern research methods; heavy and heavy oil residues, theoretical foundations and integrated schemes for the processing of residues, resins, aromatic concentrate, product processing.	4											
D11	Spectral methods in petrochemistry	The methods of obtaining, identifying and studying the properties of substances (materials); standard methods for processing experimental results; the main areas of use of modern equipment for research; The principle of operation of modern equipment for research.	4											
	Chromatographic methods of hydrocarbon analysis	Chromatographic methods of analysis are based on cyclic acts of sorption and desorption occurring between the mobile phase (eluent) with a dissolved sample and an immobile sorbent. The components of complex mixtures	4											

		have different sorbability, passing along the stationary phase, they are absorbed at different rates and in different amounts.																		
D12	Petrochemistry (English)	The composition of oil, the main methods of its processing. Preparation of technological schemes of processing of hydrocarbon raw materials. Calculation of the material balance of the process, physical and chemical properties of oil and petroleum products. Method of calculation of the main petrochemical equipment. Methanol synthesis. Synthesis of carboxylic acids. The oxo process. Carbonylation reaction. Fischer-Tropsch Synthesis.	5																	
	Separation of aromatic hydrocarbons from reforming	Chemistry and technology of catalytic reforming and hydrocracking processes. Catalytic reforming of gasolines, process variants. Extractive separation of aromatic hydrocarbons from gasoline and kerosene-gas oil fractions. Removal of aromatic, sulphurous and resinous components from oil distillates and deasphalted oils.																		
D13	Inorganic substances in oils	It is studied in order to form knowledge about the mineral components of petroleum raw materials; mineral components of oil; trace elements, classification; relic microelements, quantitative distribution by fractions, forms of occurrence; concentration and isolation; demetallization of crude oil; theoretical and technological foundations; raw materials for demetallization; heavy and heavy oil residues, spent catalysts, oil-bituminous rocks, high-viscosity oils.	5																	
	Theoretical bases of oil refining	It is studied in order to form knowledge about the chemistry, mechanism, kinetics and thermodynamics of primary processing, thermal cracking, catalytic processes: catalytic cracking, reforming, hydrotreating, hydrocracking, isomerization, alkylation; Questions of the theoretical foundations of the processes of oil, gas, coal processing are considered.																		
D14	Production of greases	It is studied in order to form knowledge about the properties and production technology of greases; classification and general principles for the preparation and commercial petroleum products; main indicators of the quality of fuels																		

		and lubricants, binders and solid hydrocarbons in accordance with technical standards: classification and mechanisms of action of additives to fuels and lubricants: hydrotreating of lubricating oils and paraffins																																							
	New polymer materials for the petrochemical industry	Biopolymers, synthetic plastics, plastics, biodegradable materials, Synthetic polymers based on plastics, Compostable plastics, Reproducible natural polymers, components of agricultural or wild plants (starch, cellulose, lignin), petrochemical products, Ways of modernization of the oil refining complex.	5																																						
D15	Petrochemical industry modeling	Types, principles and methods of creating mathematical models, features of solution methods, applied software tools for calculating processes and apparatuses: methods and means of improving technological processes, measures for the integrated use of raw materials, replacement of scarce materials and finding ways to dispose of waste from petrochemical production.		+																																					
	Design development of oil refining enterprises	It is studied in order to form knowledge about the design of gas and oil processing enterprises: project documentation: labor protection and production management: estimates and organization of construction: performing calculations and developing norms for maximum permissible emissions of pollutants into the environment, waste disposal: design solutions to reduce air pollution.	6																																						

Coordination of the planned learning outcomes with the methods of teaching and evaluation within the module

Learning outcomes	Planned learning outcomes for the module	Teaching methods	Assessment methods
SR1	Analyzes the main patterns of the development of science and technology in the field of chemistry and chemical engineering, and the ways of approach to the study of the development of the fields of chemical engineering. Conducts selection and systematically combines knowledge of scientific problems of chemistry and chemical engineering, methods of scientific research in engineering systems and uses them in specific situations	Interactive lecture, discussion	Test
SR2	He is proficient in experimental methods for solving complex problems of petrochemistry and chemical engineering, plans and conducts chemical and technological experiments. Shows the skills of logical and analytical thinking in solving tasks and their proper documentation	Lecture, conversation	Test, colloquium
SR3	Able to carry out professional activities; possess technologies of independent learning and self-education, the ability to improve and develop their intellectual, general cultural and professional level. Is able to conduct and operate a production line, participates in the development and modernization of technological schemes for the production of petroleum products, coal substances	Case study, discussion, story	Control work, oral - interview
SR4	Uses innovative methods in conducting various types of classes in technological disciplines in pedagogical activity. He is able to draw up work schedules, applications, instructions, explanatory notes, diagrams and other technical documentation, as well as prepare reports	Project training, conversation	Presentation, test
SR5	Analyzes alternative solutions to research and practical problems and evaluates the potential for the implementation of these options, when solving research and practical problems and is able to generate new ideas. Applies modern information and communication technologies in the research, development and production of petrochemical and carbon chemical substances	Interactive lecture	Test, colloquium
SR6	Applies public speaking skills, is able to argue, discuss, analyze; has practical logic. Speaks a foreign language to the extent necessary to obtain professional content information from foreign sources	Interactive lecture	Test, colloquium
SR7	He knows the basic norms adopted in scientific communication in his native and foreign languages. He has the skills of analyzing scientific texts, various methods, technologies in the implementation of professional activities in his native and foreign languages	Interactive lecture	Test, colloquium
SR8	Capable of performing work in the field of scientific and technical activities for design, information service, organization of production, labor and management, metrological support, technical control. Develops a feasibility study, solves the possibilities of reducing the cycle of work, facilitates the preparation of the process of their implementation, provides the necessary technical data, materials and	Interactive lecture	Test, colloquium

	equipment		
SR9	Conducts an examination of technical documentation, supervision and control over the condition and operation of technological equipment, identifies reserves, establishes the causes of existing deficiencies and malfunctions in operation, takes measures to eliminate them and improve the efficiency of production processes. Applies international and domestic standards, resolutions, orders, orders of higher and other domestic organizations, methodological, regulatory and guidance materials related to the work performed; principles of operation, technical characteristics, design features of domestic and foreign equipment used	Interactive lecture, discussion	Test, colloquium, project preparation
SR10	He is able to choose and apply experimental and factorial research methods in his professional activity. Uses the skills of applying knowledge of the fundamental laws of chemistry and chemical technology to solve research problems in the subject area	Interactive lecture, discussion	Test, colloquium, project preparation
SR11	Selects and applies experimental and factorial research methods in professional activity; interprets and evaluates experimental data and is able to identify substances. Applies experimental and theoretical methods of analytical determination of chemicals and uses spectral devices, and knows about the sensitivity and resolution of the analytical method. Able to develop educational programs based on a competent approach, modular principle, system of credits; to select and use optimal methods of teaching and evaluating students' academic performance	Interactive lecture, discussion	Test, colloquium, project preparation
SR12	Owens the technology of designing the educational process at the level of higher education; methods and technologies of teaching and evaluating the progress of students. Selects and applies experimental and computational-theoretical research methods in professional activity; interpret and competently evaluate experimental data, identify substances. He is able to lead a team of specialists, solve production problems related to multiple interrelated factors, take responsibility for setting the task and the results obtained	Lecture, project training, discussion	Test, project preparation
SR13	Shows skills when searching for information from all types of scientific and technical documentation, including scientific reports, reviews, reports and articles. Has the skills to present and promote the results of intellectual activity. Shows knowledge about the current state of science, problems, and methods of research activity in the subject area	Lecture, project training, discussion	Test, project preparation

The graduate model of the educational program


Graduate Attributes:

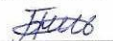
- High professionalism in the field of education and chemistry
- Emotional intelligence
- Adaptability to global challenges
- Leadership
- Entrepreneurial thinking
- Global citizenship
- Understanding the importance of the principles and culture of academic integrity

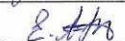
Types of competencies	Description of competencies
1. Behavioral skills and personal qualities (Softskills)	High level of culture, scientific and technical outlook, ability to use the basic principles and methods of social, humanitarian and economic sciences in solving social and professional tasks. Ability to analyze socially significant problems and processes, readiness for responsible participation in political life. The ability to work with information in global Internet resources, as well as to use regulatory and legal documents in their professional activities.
2. Digital competencies (Digital skills)	Ability to work with information in global computer networks. Knows the basics of programming, owns programs in the organization of control of incoming raw materials and materials in the production of motor fuel and raw materials for petrochemicals. Uses digital technologies for the efficient use of equipment, raw materials and auxiliary materials, determines the composition and properties of intermediate products and finished petroleum products and materials. Simulates and optimizes production facilities, conducts experimental work on testing and commissioning of new equipment.
3. Professional competencies (Hardskills)	It shows a high level of professional knowledge in the field of oil refining technology, high-viscosity oils and prospects for the development of enterprises. Knows the technical requirements for heavy hydrocarbon raw materials, materials and finished products. Knows how to calculate the consumption standards of raw materials, materials and energy. He knows the basics of inventive activity, the basics of economics and production organizations, safety rules at work. Uses the skills of applying knowledge of the fundamental laws of chemistry and chemical technology to solve research problems in the field of petrochemistry. Selects and applies experimental and computational-theoretical research methods in professional activity. He is able to interpret and competently evaluate experimental data, identify substances. He is able to lead a team of specialists, solve production problems related to multiple interrelated factors, take responsibility for setting the task and the results obtained.

Developers:

Members of the working group:

Head of the Department of Chemical Technology and Petrochemistry, Associate Professor:  Tysiphan A.

Lecturer at the Department of Chemical Technology and Petrochemistry:  Balpanova N.Zh.

Engineer of the Department of Chemical Technology and Petrochemistry:  Erbolova A.

The educational program was reviewed by the Council of the Faculty of Chemistry from 24.04.24 Protocol No. 10

The educational program was reviewed at the meeting of the Academic Council from 29.04.24 Protocol No. 5

The educational program was reviewed and approved at the meeting of the University Board from 24.05.24 Protocol No. 8

Member of the Board -Vice-Rector for Academic Affairs
Director of the Department for Academic Work
Dean of the Faculty of Chemistry



M.M. Umurkulova
T.M. Khasenova
M.K. Ibrayev