MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN

KARAGANDA UNIVERSITY NAEMED AFTER E.A. BUKETOV

«AGREED»
Director of LLP «Damu-Chemistry»
_____ Koishibaev N. B.
«25» 03 2022 y.

«AGREED»
Director of LLP «Khimko»
_____ Dzhaparova G. E.
«25» 03 2022 y.

«SUBMIT»
Chairman Of The Board-Rector Of Karaganda
University named after E.A. Buketov
_____ Dulatbekov N.O.
«26» 05 2022 y.

EDUCATIONAL PROGRAM
in the direction of training " 7M071 Engineering and engineering"
Level: Master

Degree: master of technical Sciences in the educational program 7M07103-Petrochemistry

Qaragandy, 2022

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

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 НРК** – Level 7
11. **Level of ОРК** – 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	4
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	4
SR8, SR9, SR12		Design development of oil refining enterprises	
	Research work	Research	14
		Undergraduate	24
	Final certification	Registration and defense of a master	12

Matrix of achievability of learning outcomes

NN	Name of disciplines	Brief description of the discipline (30-40 words)	Number of credits	Generated learning outcomes (codes)												
				SR1	SR2	SR3	SR4	SR5	SR6	SR7	SR8	SR9	SR10	SR11	SR12	SR13
	Cycle of basic disciplines University component															
D1	History and philosophy of science	The discipline is aimed at the acquisition by the undergraduate of knowledge about the properties of science as a type of cognition and socio-cultural phenomenon in its historical development. The discipline consists of three modules, the development of which contributes to the development of independent research activities, requires a deep understanding by undergraduates of the essence phenomenon of science	4	+			+									

D2	Higher School Pedagogy	The discipline "Pedagogy of higher education" forms the basic knowledge and skills of scientific research, their practical use in real pedagogical activity among undergraduates; ideas about the psychological foundations, essence and content of the pedagogical activity of a teacher of higher education, improving the general and psychological culture of future researchers	4		+	+										
D3	Psychology of management	The discipline is aimed at forming ideas about modern trends in scientific management. Undergraduates will be able to navigate the main sections of this discipline: the psychological content of managerial activity, the individual managerial concept of the leader, the theoretical foundations of managerial interaction, the psychological features of the implementation basic managerial functions, the psychology of the subject managerial activity	4	+						+						
D4	Foreign language (professional)	The purpose of the discipline is to form professional foreign language speech, which allows to implement various aspects of the professional activity future specialists in order to increase level of professional competence of a specialist. The target setting of the course is based on the training undergraduates in speech communication in a foreign language within the scope of the program	4	+	+											
Cycle of basic disciplines Component of choice																
D5	Thermal processes in petrochemistry	The course studies the main sources of hydrocarbon raw materials, the theoretical and technological foundations of the processes of its processing of petroleum products. The discipline is aimed at the formation of a system of knowledge and practical skills to ensure the influence of thermodynamic, kinetic parameters and the composition of raw materials on the flow of petrochemical synthesis processes	5				+						+			

	Reading and translation of English scientific literature	The purpose of the discipline is to form students' competencies in the field of professional activity, a system of language knowledge and communicative skills and skills of practical knowledge of a modern foreign language to get acquainted with new achievements in the relevant field of professional activity, improve the general culture and culture of speech		+													+
D6	Commercialization of the results of scientific and technical activities	The purpose of mastering the discipline is the formation of an integral system of knowledge that describes the process of commercialization of the results of scientific and technical activities in the field of information technology. The content of the course contributes to the acquisition of skills for the implementation of planning these activities in order to obtain the final result	5									+	+				
	Calculations in the design of petrochemical plants	The main goal is to strengthen the personnel potential of the oil complex by developing the necessary professional competencies for undergraduates in the oil and gas profile. The content of the course is aimed at the formation of knowledge about the basics designing enterprises of the oil refining and petrochemical complex, the layout of process equipment and general plant facilities						+								+	
D7	Actual problems of cavitation processing of heavy hydrocarbon raw materials	The discipline contributes to a deep understanding by undergraduates of the essence and value, as well as the ability and readiness to carry out the process of cavitation processing of heavy hydrocarbon raw materials in accordance with the regulations and use technical means to measure the main parameters of technological processes for processing petroleum raw materials	5						+					+			
	Petrochemistry and ecology	The purpose of mastering the discipline "Petrochemistry and Ecology" is to study the history of development, the current state and promising areas of theoretical petrochemistry and industrial practice in the extraction and processing of petroleum feedstock. The content of the course is aimed at creating the scientific foundations for the production of technically useful products and alternative fuels					+						+				

D8	Selectivity and stereospecificity of catalysts in petrochemistry	The aim of the discipline is to study modern theoretical concepts and experimental methods in the field of catalysis. The discipline forms in-depth knowledge of undergraduates about catalytic processes, modern theoretical ideas in the field of homogeneous and heterogeneous catalysis and modern ideas about nanocatalysts	4			+								+		
D9	Technology of heterolytic and homolytic refining processes	The discipline "Technology of heterolytic and homolytic refining processes" is intended for undergraduates to study the theoretical foundations for solving practical problems, laying the scientific foundations of chemistry, kinetics and technology of hydrocarbon processing processes, acquiring skills in technological and structural calculation of equipment for oil refining and petrochemical industries	4					+	+							
D10	Technology for processing heavy hydrocarbons	The purpose of studying the discipline: to form the ability to use the knowledge of the physical and chemical features of the technology of processing heavy oil raw materials in order to increase the depth of oil refining. Preparation of undergraduates for production and technological activities in the field of processing of secondary products from oil	4						+			+		+		
D11	Spectral methods in petrochemistry	The discipline is aimed at mastering spectral methods in petrochemistry. The content of the course consists of sections that form knowledge about modern equipment in the course of scientific research; the principle of operation of modern equipment in scientific research	4				+		+					+		
	Chromatographic methods of hydrocarbon analysis	This discipline is aimed at obtaining knowledge, skills and abilities in the field of gas chromatography. The content of the discipline will allow applying knowledge to analyze the component composition of natural, associated and liquefied gas, to determine the component and fractional composition of oil and oil products, etc.					+						+	+		
D12	Petrochemistry (english)	The purpose of mastering the discipline "Petrochemistry (in English)" is to study the history of development, the current state and promising areas of theoretical petrochemistry and industrial practice in the extraction and processing of petroleum feedstock in a foreign language. Studying and mastering knowledge	5	+			+									

		regarding petrochemistry in English														
	Separation of aromatic hydrocarbons from reforming	The discipline forms knowledge about the technological processes of catalytic reforming and hydrocracking. The content of the course is aimed at studying the following sections: catalytic reforming of gasoline, extraction separation of aromatic hydrocarbons from gasoline and kerosene-gas oil fractions, the study of which is necessary for the development of this course					+			+			+			
D13	Inorganic substances in oils	The discipline forms and deepens knowledge in the field of chemistry of inorganic substances of oil: - about the composition and properties of oil systems, gases of various origins; - about methods of their research. The course content considers the relationship between the composition, thermodynamic conditions and physico-chemical properties of petroleum systems	5				+							+		
	Theoretical bases of oil refining	The purpose of the course is to consider the main regularities of the physical processes of oil, gas and gas condensate processing; modern technological schemes of physical processes; methods of regulation of technological parameters of processes; methods for improving these technologies in English			+				+						+	
D14	Production of greases	The purpose of mastering the discipline is to form a system of competencies for undergraduates to solve professional problems for the effective use of agricultural machinery and technological equipment at enterprises of various organizational and legal forms; to ensure high performance and safety of machines, mechanisms and technological equipment	5				+			+				+		
	New polymer materials for the petrochemical industry	The discipline contributes to the formation of knowledge about the modification of polymers produced by petrochemical industries with the aim of their further metallization for use as metallized oil pipelines. This discipline significantly expands the skills of practical application of polymer products of the petrochemical industry					+						+	+		

D15	Petrochemical industry modeling	The purpose of the discipline is an in-depth mastering of the basics of mathematical modeling and optimal control of oil and gas processing by undergraduates. The content of the course is aimed at the formation of concepts about the main approaches to the development mathematical description of the main processes of oil and gas processing, types of heat exchange equipment	4	+					+			+				
	Design development of oil refining enterprises	The objectives of mastering the discipline is an in-depth study of the design of enterprises of the oil refining complex: - preparation of tasks for the development of design solutions; - conducting patent research in order to ensure the patent purity of new design solutions; - development of various options for the technological process, analysis of these options									+	+			+	

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 equipment	Interactive lecture	Test, colloquium
SR9	Conducts an examination of technical documentation, supervision and	Interactive lecture,	Test, colloquium,

	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	discussion	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	Owns 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.
Master's student of the Department of Chemical Technology and Petrochemistry: _____ Amangeldi A.A.

The educational program was reviewed by the Council of the Faculty of Chemistry from 25.03.22 Protocol No. 8
The educational program was reviewed at the meeting of the Academic Council from 28.04.22 Protocol No. 5
The educational program was reviewed and approved at the meeting of the University Board from 26.05.22 Protocol No. 12

Member of the Board -Vice-Rector for Academic Affairs **T.Z. Zhusipbek**
Director of the Department for Academic Work **G.S. Akybayeva**
Dean of the Faculty of Chemistry **M.J. Burkeev**