MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN
KARAGANDY UNIVERCITY OF THE NAME OF ACADEMICIAN E.A.BUKETOV

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«15» 03 2022.

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"APPROVED"
Chairman of the Board - Rector of Karaganda University of the name of Academician E.A. Buketov, the Doctor of Law Sciences, professor Dulatbekov N.O.
«__» _____2022 г.

EDUCATION PROGRAMME
for training purposes "7M071 Engineering"

"7M07102 Chemistry and Chemical Engineering."
Level: Master's degree

Karaganda, 2022

The "*7M071 Engineering"***Education Program was developed on the basis of this program***:**

- Law of the Republic of Kazakhstan from July 27, 2007 № 319-III "About education",
- Law of the Republic of Kazakhstan dated July 11, 1997 № 151-I. "On languages in the Republic of Kazakhstan",
- State General compulsory standard of postgraduate education from August 31, 2018 № 604
- National Qualification 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 Rules for the organization of educational process on credit technology" from October 2, 2018 № 152.
- Classifier of training areas with higher and postgraduate education from October 13, 2018. №569.
- Professional standard "Science (scientific, scientific and technical activity)", "Higher and postgraduate education (pedagogical and methodical activity)" (Approved by the Letter of the MHSD of 10.07.2015, № 10-3-16/14215).
- Sectoral Qualifications Framework "Chemical Production" (Approved by Minutes of the Meeting of sectoral commissions on social partnership and regulation of social and labor relations for mining, metallurgy, chemical, construction and woodworking industries, light industry and machine-building of August 16, 2016 № 1).

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Passportofaneducationalprogramme

1. The code and name of the educational programme: "7M07102 Chemistry and Chemical Engineering".

2.Code and classification of field of education, training area: Field of education: 7M07 Engineering, manufacturing and construction industries. Field of study: 7M071 Engineering and Engineering.

3. Education Programme Group: Chemistry and Chemical Engineering.

4. Credit volume. The total workload for the whole period of Master's study is 120 academic credits (2 years);

Requirements for applicants: Bachelor of Engineering and Technology in the specialty 5B072100 - Chemical Technology of Organic Substances, Bachelor of Engineering and Technology in the educational program "6B05302 Chemistry and Chemical Engineering".

Prerequisites for mastering the program:

- in case of coincidence of profile of educational program of a master's degree with the program of higher education - is not required
- in the event that the profile of a master's degree program does not coincide with a higher education program:

For applicants from chemical specialties - Technology of hydrocarbon raw materials processing - 9 ESTC;

For applicants from non-chemical specialties - Organic Chemistry - 11 ESTC; Introduction to specialty - 4 ESTC.

5. Form of training: full-time,term of study: 2 years.

6.Language of instruction: Russian, kazakh.

7. Degree awarded. The graduate of the Master's degree is awarded with the degree "Master of Technical Sciences in the educational program *"7M07102 Chemistry and Chemical Engineering"*.

8. Type of education programme: innovative.

9. Level according to ISCED – Level 7.

10. Level according to NQF – Level 7.

11. Level according toSQF – Level 7.

12. Distinguishing features of the Educational Programme

13. The number of the appendix to the license for the direction of training.

Appendix to the state license for educational activity: KZ83LAA000184956, application № 016, date of issue 28.07.2020.

14. Name of accreditation body and duration of accreditation of the study programme. Accreditation of the educational program: Independent Kazakhstan Agency for Quality Assurance in Education (NCA-OKO), Certificate IA № 0086 of 02.04.2018 validity date 02.04.2018. – 31.03.2023.

15. The purpose of the educational program: training qualified specialists who have practical and theoretical knowledge in the field of future professional activity, based on international standards of postgraduate engineering education, ensuring their competitiveness.

16. Graduate Qualification Profile for the Educational Programme "7M07102 Chemistry and Chemical Engineering".

a) The list of jobs held: Chemist; Chemist-technologist; Technologist; Technician; Scientific worker; Laboratory Technician; Engineer; Senior Laboratory Technician; Junior Scientific worker; Specialist at the departments of the university in the field of chemistry; teacher of secondary, secondary and higher educational institutions, etc.

b) The sphere and objects of professional activity of the graduates of the educational program *"7M07102 Chemistry and Chemical Engineering"* is:

- oil refining industry;

- polymer production and processing;
- geology and hydrogeology;
- mining industry;
- food industry;
- science and education.

The objects of professional activity of masters under the educational program *"7M07102 Chemistry and Chemical Engineering"* are:
- enterprises producing organic substances, polymers, elastomers, paintwork materials, powders, solid and liquid rocket fuels;
- enterprises for oil, gas and coal processing;
- enterprises engaged in production, preparation and transportation of hydrocarbon raw materials and their rational use;
- defense enterprises;
- mining and extractive industries;
- research and design industry institutes;
- secondary technical and higher educational institutions;
- chairs of chemical and special profile.

The subject of professional activity of the graduates under the educational program *"7M07102 Chemistry and Chemical Engineering"* are the products of basic and fine organic synthesis, polymers, devices and equipment of chemical technology of production and processing of organic substances and materials, various types of raw materials and auxiliary materials (including oil, gas, coal, vegetable raw materials), polymers, monomers, elastomers, chemical reagents and reagents, research instruments and equipment.

c) Types of professional activity:
- Educational, upbringing, social and communicative;
- industrial and technological;
- design and engineering;
- installation and adjustment;
- organizational and managerial;
- research.

d) Functions of professional activity:
Educational, upbringing and social and communicative activity:
- Training of youth in chemistry and technology of organic substances processing;
- education of the young generation in pedagogical and industrial activity;
- creation of friendly relations in professional environment;
- development of international cooperation in professional activity.
Production and technological activity:

- organization of collective work in the conditions of existing production;

- estimation of structure and properties of initial raw materials with the purpose of possibility of development of the new technological processes providing high quality;

- analysis of ways of improvement and modernization of technological lines, equipment with the purpose of carrying out of highly effective technological processes on production and processing of organic substances;

- carrying out of technical and economic analysis of production.

Organizational and management activities:

- Organization and realization of input control of raw materials from the point of view of possibility of production and processing of organic substances;

- implementation of technical control;

Settlement and design activity:

- Design of new and modernization of existing technological schemes, selection of technological parameters, calculation of equipment selection;

- development of design and estimate documentation, ensuring the efficiency of design solutions;

- analysis and evaluation of alternative variants of technological scheme and separate units on the basis of wide use of mathematical models.

Research and development activity:

- Planning and implementation of 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 polymers;

- creation, modeling and optimization of production units and technological schemes, solving technological problems;

- analysis of modern trends in chemical technology development in various industries.

Formulating competency-based learning outcomes

Type of competences	Training result code	Learning result (according to Bloom's taxonomy)
1. Behavioural skills and personality traits: (Soft skills)	RC4	Demonstrates the skills of logical and analytical thinking in solving tasks and properly documenting them.
	RC5	Possesses high motivation to perform professional activities; possesses technologies of independent learning and self-education, ability to improve and develop his intellectual, general cultural and professional level.
	RC10	Skills in public speaking, argumentation, discussion and polemics; practical analysis of logic of different kinds of reasoning.
	RC11	Speaks a foreign language to the extent necessary to obtain professional content information from foreign sources.
	RC12	Is able to follow the basic norms accepted in scientific communication in native and foreign languages
	RC13	Has the skills of analyzing scientific texts, various methods, technologies and types of communications in carrying out professional activities in his native and foreign languages.
2. Digitalcompetences: (Digital skills):	RC7	Applies innovative methods in conducting various types of classes in technological disciplines in teaching activities.
	RC9	Uses modern information and communication technologies in research, development and production of organic substances and products for technical and domestic purposes.
3. Professional competences: (Hard skills)	RC1	Systematizes the basic laws of development of science and technology in the field of chemistry and chemical engineering, analyzes approaches to the study of development of the fields of chemical engineering.
	RC2	Classifies 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.
	RC3	Uses methods of setting up the experiment to solve complex problems of chemistry and chemical engineering, plans and conducts chemical and technological experiments.
	RC6	Organizes and operates technological lines, takes part in the development and modernization of technological schemes for the production of petroleum products, polymers, industrial and domestic products.
	RC8	Is able to analyze alternative options for solving research and practical tasks and assess the potential opportunities for implementing these options, while solving research and practical tasks, generate new ideas that can be operationalized based on available resources and limitations.
	RC14	Develops and performs works in the field of scientific and technical activity in design, information service, organization of production, labor and management, metrological support, technical control.
	RC15	Conducts technical and economic analysis, comprehensively justifies the decisions taken and implemented, seeks opportunities to reduce the cycle of work, assists in the preparation of the process, provides the necessary technical data, materials and equipment.

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

Learning result code	Module name	Name of the discipline	Объем (ECTS)
RC4, RC5, RC8, RC10, RC12, RC13	Philosophical-historical aspect of social and humanitarian discoveries	History and philosophy of science	4
RC4, RC5, RC7, RC1, RC12, RC13		Pedagogy of higher education	4
RC4, RC5, RC10, RC12, RC13		Management psychology	4
RC4, RC6, RC7, RC8, RC10, RC12, RC13		Pedagogical practice	4
RC10, RC11, RC12, RC13	Professional languages	Foreign language (professional)	4
RC5, RC10, RC11, RC12, RC13		Professional foreign terminology in chemistry and chemical engineering	5
RC5, RC10, RC11, RC12, RC13		Academic and professional communication in chemistry in a foreign language	
RC1, RC4, RC8, RC13, RC15	Innovative process of research organization	Commercialization of the results of scientific and technical activities	5
RC1, RC2, RC3, RC8, RC10, RC13, RC14		Organization and planning of scientific research in the field of chemical sciences	
RC1, RC2, RC3, RC4, RC6, RC8, RC14, RC15		Resource-saving technologies	5
RC1, RC6, RC8, RC9, RC14, RC15		Innovation in chemistry and chemical engineering	
RC1, RC3, RC6, RC8, RC15	Chemistry and technology of processing of organic substances and fuels	New routes in synthesis and technology of producing composite materials	4
RC2, RC3, RC6, RC8, RC9, RC15		Innovative technologies of oil refining and petrochemistry	4
RC1, RC2, RC6, RC8, RC14, RC15		Modern problems of chemistry and technology of special purpose polymers	5
RC2, RC3, RC6, RC8, RC15	Modern problems of chemistry, chemical engineering and nanotechnology	Fundamentals of nanomaterials technology	4
RC2, RC3, RC6, RC8, RC15		Nanostructured polymer materials	
RC3, RC4, RC9, RC13		Molecular spectroscopy (in English)	4
RC3, RC4, RC9, RC13		Methods of statistical thermodynamics (in English)	
RC1, RC3, RC4, RC8, RC9, RC13, RC14		Contemporary issue of organic chemistry (in English)	5
RC2, RC3, RC4, RC8, RC9, RC13, RC14		Supramolecular chemistry (in English)	
RC1, RC3, RC8, RC9, RC13, RC14		Chemistry of functional materials	4
RC2, RC3, RC8, RC9, RC13, RC14		Chemistry of semiconductor materials	
RC1, RC3, RC8, RC9, RC13, RC14		Modern spectroscopic methods in organic chemistry (in English)	5

RC1, RC2, RC3, RC4, RC8, RC9, RC13, RC14		Modern methods of organic synthesis (in English)	
RC1, RC2, RC3, RC4, RC6, RC8, RC14, RC15	Research work of a master student, including internship and master's thesis (RWM)	Research practice	14
RC1, RC2, RC3, RC4, RC6, RC8, RC14, RC15		Research work of a master student, including internship and master thesis	24
	Final examination	Design and defense of a master's thesis	12

Matrix for the attainability of learning outcomes

No	Name ofdisciplines	Brief description of the discipline (30-40 words)	Numberof credits	Formativelearningoutcomes (codes)														
				RC 1	RC 2	RC 3	RC 4	RC 5	RC 6	RC 7	RC 8	RC 9	RC 10	RC 11	RC 12	RC 13	RC 14	RC 15
Cycle of basic disciplines University componen																		
D1	History and philoso-phy of science	The purpose of the discipline is to understand the main strategies of scientific research and the historical foundations for the formation of scientific knowledge. The discipline studies the general patterns of scientific knowledge in its historical development and the changing socio-cultural context. The discipline considers science as a cognitive activity, as a social institution and a special sphere of culture.	4				+	+			+		+		+	+		
D2	Pedagogy of higher education	The purpose of mastering the discipline is to master the system of knowledge about higher education, its structure, and the principles of managing educational processes. The discipline studies the main provisions of the content of higher education, modern didactic concepts in higher education; features of the design and organization of the pedagogical process at the university, modern educational technologies.	4				+	+		+			+		+	+		
D3	Management psychology	The purpose of mastering the discipline is to obtain in-depth psychological knowledge by future specialists, helping to organize and unite employees, creating a favorable psycho-logical climate in the team. The discipline studies the proce-dures and basic methods of psychological diagnostics; mod-ern theoretical concepts of personality research, organization-al and procedural principles and features of psychodiagnos-tics.	4				+	+					+		+	+		
D4	Pedagogical practice	The purpose of pedagogical practice is to study the basics of educational and methodological work at the university, mastering the pedagogical skills of conducting training sessions. Pedagogical practice is aimed at mastering modern teaching methods and technologies, as well as the use of information resources and IT technologies to solve educational problems.	4				+		+	+	+		+		+	+		
D5	Foreign language (professional)	The purpose of the discipline is the development of a foreign language communicative professionally oriented competence of students. The discipline studies the grammar and professional vocabulary of the literary and colloquial language to the extent necessary to obtain professional information from foreign sources and communicate at a professional level; reading and translating foreign texts.	4										+	+	+	+		
D6	New routes in	The purpose of teaching the discipline is to study the	4	+		+			+		+							+

	synthesis and technology of producing composite materials	manufacturing processes of composite materials to give multifunctionality and new properties, to reduce the material consumption of production. The discipline studies the development prospects in the field of production and processing of polymers, plastics and composite materials; organization and ways of improving technological processes for obtaining composite materials.																	
D7	Innovative technologies of oil refining and petrochemistry	The purpose of the discipline is to master the principles of constructing technological schemes for the processing of oil and gas raw materials, which are optimal in terms of organization and selection of process equipment. The discipline considers the physical and chemical laws of the processing of petroleum raw materials; principles of resource saving of petrochemical processes; the latest achievements of science in the field of preparation and processing of hydrocarbon raw materials.	4		+	+			+		+	+						+
D8	Modern problems of chemistry and technology of special purpose polymers	The purpose of the discipline is to acquire knowledge on the creation, modification and structural organization of polymers, the prospects for the use of materials based on polymers. The discipline studies the foundations, achievements, trends in the development of modern chemistry of special-purpose polymers and their areas of application; new approaches to the synthesis of promising polyfunctional polymers.	5	+	+				+		+						+	+
D9	Research practice	The purpose of the research practice is to acquire skills and professional competencies in the field of chemical engineering training, mastering the practical skills of research work. When conducting research practice, the undergraduate is recommended to collect the necessary theoretical and practical materials, experimental data to complete the master's thesis.	14	+	+	+	+		+		+						+	+
D10	Research work of a master student, includ-ing internship and master thesis	The purpose of the research work of undergraduates is to study, systematize the most important theoretical, methodological, technological achievements of domestic and foreign science, the application of modern methods of scientific research in the dissertation research. Preparation and implementation of a master's thesis, revealing the knowledge and skills of the graduate, analytical, creative abilities developed during the development of the dissertation.	24	+	+	+	+		+		+						+	+
Cycle of basic disciplines Component of choice																			
D11	Professional foreign terminology in chemistry and chemical engineering	The purpose of the discipline is to achieve a practical level of proficiency in modern communication technologies for academic and professional interaction in a foreign language. The discipline studies the features of an academic and professional business foreign language (lexical, grammatical aspects).	5					+					+	+	+	+		

	Academic and professional communication in chemistry in a foreign language	The purpose of the course is to update knowledge and improve competencies in the field of written and oral scientific speech in chemistry and chemical technology, which are necessary for effective communication in the academic environment. The discipline studies modern communication technologies in a foreign language for academic and professional interaction.						+					+	+	+	+		
D12	Commercialization of the results of scientific and technical activities	The purpose of the discipline is the formation of competencies in the field of legal regulation of relations arising from the transfer and commercialization of the results of intellectual activity in the process of performing research. The discipline studies the stages, forms, participants in the commercialization process, ways of protecting objects of individual property, features of the market for licenses and technologies.	5	+			+				+					+		+
	Organization and planning of scientific research in the field of chemical sciences	The purpose of the academic discipline is the formation of knowledge and skills in planning and organizing research activities based on scientific developments, identifying promising areas of scientific and innovative activities. The discipline studies modern experimental methods of research, registration of the results of scientific work, processing of scientific and technical information using modern methods.		+	+	+					+		+			+	+	
D13	Innovation in chemistry and chemical engineering	The purpose of the discipline is to study the basics of designing technological processes of high technology production. The discipline considers modern and promising computer and information technologies used in high technology industries; purpose and capabilities of modern automated control systems for technological processes of science-intensive production.	5	+					+		+	+					+	+
	Resource-saving technologies	The purpose of the discipline is to develop students' skills in organizing resource-saving processes and introducing low-waste technologies at chemical industry enterprises. The discipline examines the importance of low-waste and resource-saving technologies, non-traditional renewable energy sources, the state of the problem of energy conservation, energy saving through the use of modern technologies.		+	+	+	+		+		+						+	+
D14	Fundamentals of nanomaterials technology	The purpose of the discipline is to study the properties of materials in a nanostructured state, methods for their production and research, the formation of ideas about modern achievements in the field of nanotechnology. The discipline considers the scientific and theoretical foundations of nanochemistry, nanotechnology; nanomaterials, criteria for their determination; application of nanotechnologies in industry; features of the physicochemical properties of nanopolymers.	4		+	+			+		+							+
	Nanostructured polymer materials	The purpose of the discipline is to study the structural features and properties of nanostructured polymers, technological methods for controlling the structure of polymeric nano-			+	+			+		+							+

		materials. The course studies information about nanocomposites, the principles of creating nanostructured polymeric materials. The main technological methods for obtaining nanocomposite materials and methods for forming products based on them are considered.																	
D15	Molecular spectroscopy (in English)	The educational goal is to master the basics of light absorption by molecules of various structures and in various states of aggregation. The course studies such methods as microwave, UV, IR, Raman spectroscopy, NMR, EPR, mass spectrometry, determination of dipole moments, gas electron diffraction, Mössbauer spectroscopy.	4			+	+					+					+		
	Methods of statistical thermodynamics (in English)	The educational goal is to study the fundamental laws of thermodynamics, modern theoretical methods of physical chemistry. The discipline studies the scientific foundations of the quantum theory of chemical processes, methods for calculating energy levels, electronic-vibrational-rotational states of diatomic molecules, practical application of computational technologies in the field of quantum theory of chemical processes.				+	+					+					+		
D16	Contemporary issue of organic chemistry (in English)	The purpose of teaching the discipline is fundamental knowledge and skills on the most important methods for the synthesis of organic compounds with practically useful properties. The discipline studies theoretical questions about the mechanisms of complex reactions, problems and prospects for the synthesis of new materials used in electronics and medicine.	5	+		+	+				+	+					+	+	
	Supramolecular chemistry (in English)	The purpose of mastering the discipline is to gain knowledge about chemistry beyond molecules, about the role of non-covalent interactions in chemistry. The course deals with the concepts and terms of supramolecular chemistry, non-covalent interactions in organic chemistry, the main methods for studying non-covalent interactions, supramolecular systems based on "guest-host".			+	+	+				+	+					+	+	
D17	Chemistry of functional materials	The purpose of the discipline is to study the main types of materials in the context of their functional characteristics, methods for their production and analysis of properties. The discipline considers types of functional materials, materials with electrical and magnetic functions, structural and functional materials, and nanomaterials.	4	+		+					+	+					+	+	
	Chemistry of semiconductor materials	The purpose of the discipline is to study the fundamental aspects of the structure of semiconductor materials. This course is devoted to the study of the relationship between the chemical composition, spatial structure and properties of semiconductors, as well as the development of methods for the synthesis of new semiconductor materials with desired functional properties.			+	+					+	+					+	+	
D17	Modern spectroscopic methods in organic	The purpose of the discipline is the formation of skills to establish the structure of organic compounds. The discipline	5	+		+					+	+					+	+	

	chemistry (in English)	studies the fundamentals of the theory and practice of using physical research methods such as UV, IR, 1H NMR, 13C NMR, 2D NMR spectroscopy and mass spectrometry to solve chemical problems.																	
	Modern methods of organic synthesis (in English)	The purpose of the discipline is the formation of fundamental knowledge and skills in the field of modern organic synthesis. The course studies chemoselective, stereoselective, stereospecific, enantioselective methods of organic synthesis, retrosynthetic analysis and the use of functional group protection.		+	+	+	+				+	+				+	+	

Alignment of planned learning outcomes with the teaching and assessment methods of the module

Result code	Planned module learning outcomes	Teaching methods	Assessment methods
RC1	Systematizes the basic laws of development of science and technology in the field of chemistry and chemical engineering, analyzes approaches to the study of development of the fields of chemical engineering.	binary lecture	testing
RC2	Classifies 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.	presentation	portfolio
RC3	Uses methods of setting up the experiment to solve complex problems of chemistry and chemical engineering, plans and conducts chemical and technological experiments.	BarCamp or anti-conference	presentation
RC4	Demonstrates the skills of logical and analytical thinking in solving tasks and properly documenting them.	case study	critical analysis of the situation
RC5	Possesses high motivation to perform professional activities; possesses technologies of independent learning and self-education, ability to improve and develop his intellectual, general cultural and professional level.	project training	project preparation
RC6	Organizes and operates technological lines, takes part in the development and modernization of technological schemes for the production of petroleum products, polymers, industrial and domestic products.	basket method	critical appraisal of the literature studied
RC7	Applies innovative methods in conducting various types of classes in technological disciplines in teaching activities.	conversation technique	Self-assessment and self-assessment-students
RC8	Is able to analyze alternative options for solving research and practical tasks and assess the potential opportunities for implementing these options, while solving research and practical tasks, generate new ideas that can be operationalized based on available resources and limitations.	problematic lecture	preparing a manual on the use of the equipment for a specific audience
RC9	Uses modern information and communication technologies in research, development and production of organic substances and products for technical and domestic purposes.	round table	presentation preparation
RC10	Skills in public speaking, argumentation, discussion and polemics; practical analysis of logic of different kinds of reasoning..	interactive lecture	colloquium
RC11	Speaks a foreign language to the extent necessary to obtain professional content information from foreign sources.	discussion	comments on an article, book, monograph
RC12	Classifies 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.	training	keeping a reflectivediary
RC13	Has the skills of analyzing scientific texts, various methods, technologies and types of communications in carrying out professional activities in his native and foreign languages.	business game	perfomance
RC14	Develops and performs works in the field of scientific and technical activity in design, information service, organization of production, labor and management, metrological support, technical control.	FlippedClass	essay writing
RC15	Conducts technical and economic analysis, comprehensively justifies the decisions taken and implemented, seeks opportunities to reduce the cycle of work, assists in the preparation of the process, provides the necessary technical data, materials and equipment.	tour	articlecreation

Criteria for assessing the achievability of learning outcomes

CodesofLO	Criteria
LO1	**Knows:** the main directions of development of science and technology in the field of chemistry and chemical technology
	Able to: work with domestic and foreign scientific and technical literature and analyze the main perspectives in the field of chemistry and chemical engineering
	Master: a systematic approach to the analysis of problems and prospects of modern science and technology
LO2	**Knows:** basic methods, principles, tools for organizing and carrying out scientific research
	Able to: analyze, classify, systematize and combine knowledge about modern scientific achievements in the field of chemistry and chemical technology and use them to solve problems in the field of professional activity
	Master: engineering thinking skills
LO3	**Knows:** fundamental concepts of mathematical model and mathematical modeling
	Able to: justify the choice of a method for solving professional problems
	Master: conceptual formulation of the modeling problem
LO4	**Knows:** ways to train logical and analytical thinking
	Able to: solve professional problems, demonstrating analytical thinking skills
	Master: tools for activating analytical thinking, skills for modeling situations and developing an action strategy
LO5	**Knows:** methods, forms and tools for self-study, development and improvement of professional knowledge, skills and abilities
	Able to: work with tools for self-education and self-learning
	Master: skills and technologies of self-learning, development and improvement of professional knowledge, skills and abilities
LO6	**Knows:** production line technology
	Able to: to introduce modern achievements in the field of chemical technology into the operation of modern technological lines
	Master: skills in organizing and modernizing modern production lines
LO7	**Knows:** fundamentals and norms of digital representation of information
	Able to: effectively present information in the digital space in compliance with norms and ethics
	Master: digital ethics and legal regulation of the digital environment
LO8	**Knows:** methods for critical analysis and evaluation of modern scientific achievements, as well as methods for generating new ideas in solving research and practical problems, including in interdisciplinary areas
	Able to: analyze alternative options for solving research and practical problems and evaluate the potential advantages and disadvantages of implementing these options
	Master: skills in analyzing methodological problems that arise when solving research and practical problems, including those in interdisciplinary areas
LO9	**Knows:** main software products and applications for the development and research of organic and polymeric substances and materials
	Able to: effectively use computer programs and applications in professional activities
	Master: programming skills and user skills to solve complex production problems
LO10	**Knows:** basics of public speech, tools for effective communication
	Able to: use tools for preparing reports, presentations, for high-quality speeches in classes and scientific conferences
	Master: orientation skills in the communicative space, the ability to effectively interact with the target audience
LO11	**Knows:** basic norms of oral and written speech, grammatical constructions
	Able to: analyze educational and scientific literature in a foreign language
	Master: oral and written communication skills in a foreign language
LO12	**Knows:** theoretical foundations of physicochemical methods for the analysis of organic substances and polymeric materials
	Able to: carry out experiments using instrumental methods of analysis in the field of chemistry and chemical technology
	Master: theoretical and experimental apparatus of physical and chemical research methods
LO13	**Knows:** foundations of mathematical logic and theory of algorithms
	Able to: select, analyze and organize information, think logically and plan actions, knows how to organize work on a scientific basis
	Master: theory and regularities of algorithms, various models of representation

LO14	**Knows:** basics of management activity
	Able to: set and propose ways to solve production problems
	Master: tools for setting and solving complex production problems, as well as effective management skills
LO15	**Knows:** fundamentals of experimental and computational-theoretical research methods
	Able to: apply experimental and computational-theoretical research methods to solve problems in the field of professional activity and competently evaluate and interpret the results obtained
	Master: skills of interpreting the results of calculations and experiments

17. Model graduate of an educational programme

Graduate Attributes

Qualified, comprehensively developed and able to demonstrate an advanced level of knowledge in the field of chemistry and chemical technology; creative, inquisitive, they have a broad outlook; they are able to make collegially balanced decisions;

Ready to adapt easily to a rapidly changing world and willing to work for the good of the country;

Sincere, fair, honest, tolerant, they value ethical norms and principles.

Types of competences	Description of competences
1. Behavioural skills and personality traits (Soft skills)	Ability to critically analyze and evaluate modern scientific achievements, generate new ideas in solving research and practical problems of chemistry and chemical technology, including in interdisciplinary areas; headiness for communication in oral and written form in the state, Russian and foreign languages for solving tasks of professional activity; ability to design and carry out complex research, including interdisciplinary research, based on a holistic systemic scientific worldview using knowledge in chemistry and chemical engineering; willingness to participate in the work of Kazakhstan and international research teams to solve scientific and scientific and educational problems in the field of chemistry and chemical technology
2. Digital competences (Digital skills):	The ability to select and apply info communication technologies confidently, effectively and safely in different areas of professional activity, based on the continuous acquisition of knowledge, skills, motivation, responsibility (information search, use of digital devices, use of social media functionality, critical perception of information, production of multimedia content, etc.).
3. Professional competences (Hard skills)	Evaluates various methods and approaches to solving technological problems and chooses the optimal method, develops innovative and alternative technological schemes of real chemical production, applies problem solving methods in unfamiliar situations; carries out scientific, innovative activities to obtain new knowledge in chemistry and chemical technology, creates new applied knowledge in chemistry and chemical engineering, is able to transfer the results of conducted research in the form of specific recommendations in terms of chemistry and chemical engineering; has skills of work on modern educational and scientific equipment at carrying out of chemical experiments, has an operational experience on the serial equipment applied in analytical and physicochemical researches, possesses methods of registration and processing of results of chemical and chemical technological experiments; summarizes and critically evaluates the results of research on topical problems of chemistry and technology obtained by domestic and foreign researchers, substantiates the relevance, theoretical and practical significance of the chosen topic of scientific research, and presents the results of the research in the form of a scientific report, article or report.

Developers:

Candidate of Chemical Sciences, Associate Professor — Ye.V. Minayeva
Senior Lecturer — Zh.B. Satpayeva
Head of the Department of Organic Chemistry and Polymers — T.S. Zhumagaliyeva
Master's Student — E. Nasikhatuly

Notes.

The educational program was reviewed and recommended at the Faculty Council from _____ Protocol No.
The educational program was considered at the meeting of the AC and recommended for approval by _____ Protocol No.
The educational program was reviewed and approved at a meeting of the Academic Council from _____ Protocol No.

Board Member, Vice-Rector for Academic Affairs — T. Z. Zhussipbek
Director of the Department of Academic Affairs — G.S. Akybayeva
Dean of the Faculty of Chemistry — M.Zh. Burkeyev