

MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE REPUBLIC
OF KAZAKHSTAN

M. Auezov SOUTH KAZAKHSTAN UNIVERSITY



EDUCATION PROGRAM

7M07162-Chemical technology of inorganic substances

Registration number	7M07100002
Code and classification of the field of education	7M07-Engineering, Manufacturing and Civil Engineering
Code and classification of training areas	7M071- Engineering and engineering Trades
Group of educational programs (EP)	M097-Chemical engineering and processes
Type of EP	Active
ISCE level	7
NQF level	7
IQF level	7
Language of learning	English, Kazakh, Russian
The complexity of EP	120 credits
Distinctive features of EP	-
University Partner (JEP)	-
University Partner (DDEP)	-

Shymkent, 2024

Developers:

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The Education Program was considered at a meeting of Academic Quality Committee of the Higher School "Chemical Engineering & Biotechnology", Minutes # 7 from 23. 02. 2024.

Chairman of the Committee N. Daurenbek

The EP was considered and recommended for approval at a meeting of Educational-Methodical Council of M. Auezov SKU

Minutes #4 from 28.02 2024.

Chairman of the EMC K. Sarykulov

The EP was approved by decision of the Academic Council of the University

Minutes # 10 from 28.03 2024.

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1 CONCEPT OF THE EDUCATION PROGRAM

The university mission	We are focused on generating new competencies, training a leader who translates research thinking and culture.
University values	<ul style="list-style-type: none"> • Openness – open to change, innovation and cooperation. • Creativity – generates ideas, develops them and turns them into values. • Academic freedom - free to choose, develop and act. • Partnership – builds trust and support in relationships where everyone wins. • Social responsibility - ready to fulfill obligations, make decisions and be responsible for their results.
Graduate Model	<ul style="list-style-type: none"> • Deep subject knowledge, its application and constant expansion in professional activity. • Information and digital literacy and mobility in a rapidly changing environment. • Research skills, creativity and emotional intelligence. • Entrepreneurship, independence and responsibility for their activities and well-being. • Global and national citizenship, tolerance for cultures and languages.
EP uniqueness	<ul style="list-style-type: none"> • Practice orientation and orientation to the regional labor market and social order through formation of graduate professional competencies, adjusted to stakeholders requirements. • The EP is accredited by the Independent International Agency ASIIN (Germany) in 2021, allowing the recognition of the MSc degree in the international labour market.
Academic Integrity and Ethics Policy	<p>The university has taken measures to maintain academic integrity and academic freedom, protection from any type of intolerance and discrimination:</p> <ul style="list-style-type: none"> • Rules of academic integrity (order No. 212 of October 10, 2022); • Anti-corruption standard (order No. 221 n/a dated 12/07/2021); • Code of Ethics (Order No. 212 of October 10, 2022).
Regulatory and legal framework for EP development	<ol style="list-style-type: none"> 1. Law of the Republic of Kazakhstan “On Education”; 2. Model rules for the activities of educational organizations implementing educational programs of higher and (or) postgraduate education, approved by order of the Ministry of Education and Science of the Republic of Kazakhstan dated October 30, 2018 No. 595 with amendments and additions dated December 29, 2021. No. 614; 3. Standard rules for admission to training in educational organizations implementing educational programs of higher and postgraduate education, approved by order of the Ministry of Education and Science of the Republic of Kazakhstan dated October 31, 2018 No. 600 with amendments and additions dated 06/02/2023. No. 252; 4. State mandatory standards for higher and postgraduate education, approved by order of the Ministry of Education and Science of July 20, 2022 No. 2;

	<p>5. Rules for organizing the educational process in credit technology of education, approved by order of the Ministry of Education and Science of the Republic of Kazakhstan dated April 20, 2011 No. 152; with changes and additions from 09/23/2022. No. 79;</p> <p>6. Qualification reference book for positions of managers, specialists and other employees, approved by order of the Minister of Labor and Social Protection of the Population of the Republic of Kazakhstan dated December 30, 2020 No. 553;</p> <p>7. Methodological recommendations for introducing ECTS principles into the educational process and expanding academic freedom; Appendix to the order of the Minister of Science and Higher Education. of the Republic of Kazakhstan dated February 12, 2024 No. 57;</p> <p>8. Guidelines for the development of educational programs for higher and postgraduate education, Appendix 1 to the order of the Director of the National Center for the Development of Higher Education of the Ministry of Education and Science of the Republic of Kazakhstan dated May 4, 2023 No. 601 n/k.</p>
Organization of the education process	<ul style="list-style-type: none"> • Implementation of the Bologna Process principles • Student-centered learning • Availability • Inclusiveness
EP quality assurance	<ul style="list-style-type: none"> • Internal quality assurance system • Involvement of stakeholders in the EP development and its evaluation • Systematic monitoring • Updating the content
Requirements for applicants	<p>They are established in accordance with the Standard Rules for admission to training in educational organizations implementing educational programs of higher and postgraduate education by an order of the Ministry of Education and Science of the Republic of Kazakhstan No. 600 dated October 31, 2018, with changes and additions dated June 2, 2023, No. 252.</p>
Conditions for the implementation of educational programs (EP) for persons with disabilities and special educational needs (SSN)	<p>For students with SEN (special educational needs) and persons with disabilities (PSI), tactile PVC tiles, specially equipped toilets, a mnemonic diagram, and shower bars have been installed in educational buildings and student dormitories. Special parking spaces have been created. Crawler lift installed. There are desks for people with limited mobility (PLM), signs indicating the direction of movement, ramps. In the educational buildings (main building, building No. 8) there are 2 rooms with six working places adapted for users with disorders of the musculoskeletal system (DMS). For visually impaired users, the SARA™ CE Machine (2 pcs.) is available for scanning and reading books. The library website is adapted for the visually impaired. There is a special NVDA audio program with a service. The JIC website http://lib.ukgu.kz/ is open 24/7.</p> <p>An individual differentiated approach is provided for all types of classes and in the organization of the educational process.</p>

2 PASSPORT OF THE EDUCATION PROGRAM

EP goal	Training of in-demand scientific and pedagogical personnel in “Chemical Engineering” field for higher education system and scientific area
EP objectives:	<ul style="list-style-type: none"> - providing conditions for acquiring a high intellectual level of development, mastering logical and critical thinking and the skills of the scientific organization of labor in scientific and pedagogical activity; -development of the ability to use acquired knowledge in professional activities to solve scientific, managerial and technological tasks, operational decision making in problem situations; - the development of self-study skills and continuous professional development throughout the professional activity, which will enable masters to successfully adapt to the dynamically changing conditions of the labor market; - formation of graduates' competitiveness in the field of chemical engineering to provide employment opportunities in the specialty or continuing education in doctoral studies; - establishing conditions for the development of in-demand knowledge and skills, as well as a conscious attitude towards enhancing the welfare of society and conserving the planet within the framework of the SDGs.
Harmonization of EP	<ul style="list-style-type: none"> • 7th level of the National Qualifications Framework of the Republic of Kazakhstan; • Dublin descriptors of the 7th level of qualification; • 2 cycle of a Framework for Qualification of the European Higher Education Area); • 7th Level of European Qualification Framework for Lifelong Learning).
EP connection with the professional sphere	<ul style="list-style-type: none"> • Industry qualifications framework “Chemical production” (Attachment No. 2 approved by the Meeting of industry commissions on social partnership and regulation of social and labor relations for mining and metallurgical, chemical, construction and woodworking, light industry and mechanical engineering from August, 16th, 2016, minutes № 1); • Professional standard “Pedagogue” (Application to the order of the Ministry of Education and Science of the Republic of Kazakhstan dated November 20, 2023, No. 591); • Professional standard "Operational and Dispatch Control", Annex No. 8 to the order of the Acting Chairman of the Board of the National Chamber of Republic of Kazakhstan Entrepreneurs "Atameken" No. 224 dated 06.12.2022.
Name of the degree awarded	After successful completion of this EP, the graduate is awarded the degree of “Master of Technical Sciences” on the educational program “Chemical technology of Inorganic Substances”
List of qualifications and positions	<ul style="list-style-type: none"> • Head of the relevant specialization unit in the enterprise; • Shift supervisor; • Chief technologist, • Head of control dispatch center,

	<ul style="list-style-type: none"> • Head of the Department of State Bodies in the Field of Chemical Engineering, • Lead Designer, Chemical Engineer in Design and Research Institutes; • Teacher in higher educational institutions.
Professional area	<ul style="list-style-type: none"> • Industrial enterprises for the production of inorganic compounds; • Higher education institutions; • Research and project institutes.
Objects of professional activity	<ul style="list-style-type: none"> - chemical technology of inorganic compounds; - mineral natural and technogenic raw materials; - waste of chemical productions; - technological processes and devices; - design documentation; - technological scheme of production; - primary labor collectives and groups of students; - management of primary labor collectives; - methods and devices for the research of inorganic compounds; - educational and methodical documentation, technical means of education; - scientific research work.
Subjects of professional activity	<ul style="list-style-type: none"> - research of inorganic compounds; - improvement of technological processes and equipment; - modernization of existing industries; - analysis and solution of problem production situations; - design of production of inorganic substances; - organization of operational dispatch control; - management of primary labor collectives; - management and regulation of the production process; - analysis of quality of raw materials and products; - assessment of the environmental safety of chemical production; - teaching specialized disciplines in chemical engineering; - education of trainees.
Types of professional activity	<ul style="list-style-type: none"> - organizational and administrative activity. industrial and technological activity; - settlement and design; - scientific-and-research activity; - pedagogical activity.
Learning outcomes	<p>LO1 Critically analyze scientific and technical information in the field of chemical engineering, applying knowledge of a foreign language and information resources, summarizing research results in scientific articles, reports and dissertation taking into account principles of scientific ethics.</p> <p>LO2 Analyze ideological and methodological problems, including of interdisciplinary nature based on provisions of the philosophy of science and research methodology.</p> <p>LO3 Apply scientific organization of pedagogical activity in higher education demonstrating possession of socio-psychological technologies for managing mass behavior, effective teaching methods in the field of chemical engineering.</p> <p>LO4 Effectively coordinate a work of enterprise departments, showing</p>

	<p>leadership qualities and critical thinking when making operational management decisions in non-standard situations.</p> <p>LO5 Organize operational dispatch control of the production process for obtaining inorganic compounds, applying knowledge and skills to analyze problems in interdisciplinary related fields of knowledge.</p> <p>LO6 Suggest ways to modernize the technological scheme of production, new methods of recycling industrial waste from production of inorganic substances and compounds based on analysis of modern achievements in science and technology.</p> <p>LO7 Independently plan and carry out scientific research, substantiating and proving research results when discussing with specialists and a wider audience in domestic and international scientific community.</p> <p>LO8 Analyze the experimental results and results of mass and heat calculations of studied chemical-technological processes using mathematical modeling programs to justify the optimal production mode.</p> <p>LO9 Develop acquired knowledge and skills to a level that allows to study in a doctoral program, to improve qualification lifelong.</p>
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3 COMPETENCES OF EP GRADUATE

General competences (SOFT SKILLS): Behavioural skills and personality skills	
GC 1. Competence in managing their own literacy	<p>GC1.1 Strive for lifelong professional and personal growth.</p> <p>GC1.2 To continually update and deepen knowledge within the chosen pathway and in an interdisciplinary environment, with a high degree of independence.</p> <p>GC 1.3 To be capable of reflection, objective assessment of own achievements, awareness of the need to form new competencies during doctoral studies.</p>
GC 2. Language competence	<p>GC 2.1 The ability to communicate in the state, Russian and foreign languages, both verbally and in writing, with a sufficient level of proficiency in the professional field.</p> <p>GC 2.2 Skill in mediation and intercultural understanding in an international environment.</p>
GC 3. Mathematical and scientific competence	<p>GC 3.1 Ability to interpret methods of mathematical analysis and modelling to solve applied problems in the field of study.</p> <p>GC 3.2 The ability to plan the setting up of scientific experiments and to integrate and implement the results of research work in the professional sphere.</p> <p>GC 3.3 Ability to analyse and comprehend modern methods of pedagogical and psychological science and to apply them in pedagogical activities.</p>
GC 4. Digital competence, technological literacy	<p>GC 4.1 The ability to confidently use modern information and digital technology, artificial intelligence systems for work, leisure and communication.</p> <p>GC 4.2 Proficiency in the use, recovery, evaluation, storage, production, presentation and exchange of information across a wide range of digital devices.</p>

	GC 4.3 The ability to confidently use global information resources and apply technological literacy to research and computational and analytical activities.
GC 5. Personal, social and learning competences	GC 5.1 To master the norms of business ethics, social and ethical values and to be oriented on them in professional activities. GC 5.2 Forming an identity capable of mobility in the modern world, of critical thinking and of physical self-improvement. GC 5.3 The ability to work in a team, to argue correctly and reasonably in discussions and to make professional decisions. GC 5.4 The ability to find compromises, to relate their point of view to that of the team.
GC 6. Entrepreneurial competence	GC 6.1 Demonstration of leadership skills and the ability to have a positive impact on others and to lead a team. GC 6.2 The ability to enable the development of the team's creative and entrepreneurial skills. GC 6.3 The ability to work under uncertainty and rapidly changing conditions, to make decisions, to react to changing work conditions, to allocate resources and to manage their own time.
GC 7. Cultural awareness and self-expression	GC 7.1 The ability to demonstrate a general outlook, civic and moral position. GC 7.2 The ability to be tolerant of the traditions and culture of the people of the world, with high spiritual qualities.
Professional competences (HARD SKILLS) Theoretical knowledge and practical skills specific to the field of study	
PC 1. Research competence	PC 1.1 Ability to organise and carry out research work in the field of chemical engineering. PC 1.2 The ability to experiment and summarise the results of research work in the form of scientific publications, to defend their position in discussion and to make professional decisions under conditions of uncertainty and risk;
PC 2. Methodological competence	PC 2.1 Ability to analyse and comprehend the realities of modern theory and practice on the basis of the methodology of natural science knowledge, to apply new methods of teaching profile disciplines in pedagogical activity; PC 2.2 Ability to carry out detailed analysis of scientific and technical information in the field of chemical technology of inorganic compounds for the purpose of scientific, patent and marketing support of ongoing scientific research;
PC 3. Pedagogical competence	PC 3.1 Ability to demonstrate professional values: professionalism; innovativeness; creativity; meritocracy; integrity.

3.1 Matrix for correlating EP learning outcomes as a whole with formed competencies

	LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	LO9
GC1		+							+
GC2	+						+		
GC3			+			+	+	+	
GC4	+							+	
GC5	+		+	+					+
GC6				+	+	+		+	
GC7		+	+						
PC1	+						+		
PC 2		+	+		+	+			
PC 3	+		+	+					

4. MATRIX OF THE INFLUENCE OF MODULES AND DISCIPLINES ON LEARNING OUTCOMES FORMATION AND INFORMATION ON LABOR INTENSITY

Module	Cyc le	Co mpo nent	Discipline title	Brief description of the discipline	Numb er of credits	Formed LO (Codes)								
						LO 1	LO 2	LO 3	LO 4	LO 5	LO 6	LO 7	LO 8	LO 9
Module of Scientific and Pedagogical Training	BD	HSC	History and Philosophy of Science	<p>Goal: Study of problems of science phenomenon as a subject of special philosophical analysis, regularities and trends in development of special activities for production of scientific knowledge taken in a socio-cultural context.</p> <p>Contents: Identification of specifics and relationship of main problems of history and philosophy of science. Regularities of development of science and structure of scientific knowledge, methods of scientific research. Analysis of realities of modern theory and practice based on understanding methodology of natural science, socio-humanitarian and technical knowledge. Critical thinking as a prerequisite for development and functioning of modern society. Formation of critical reflexive thinking and metacognitive abilities.</p>	4		v		v					
	BD	HSC	Foreign Language (Professional)	<p>Goal: Systemic deepening of communicative competence within the framework of foreign language education's international standards based</p>	4	v						v		v

			<p>on further development of skills and abilities' active language proficiency in the professional activities.</p> <p>Contents: Levels B2, C1 are presented in the form of pragma-professional orientation for professional and academic aims at an advanced level: scientific information base, interpretation of scientific information, argumentation, persuasion, scientific controversy, academic writing. Use of innovative methods and technologies, attraction of modern means (Internet resources). Demonstration of language material's knowledge in any related discipline.</p>										
BD	HSC	Psychology of Management	<p>Goal: To ensure the competence of a psychologist by mastering knowledge in the field of psychological management, developing skills in managing the human resources organization.</p> <p>Contents: Methodological foundations of management psychology. Development of psychological theories of management. General theoretical questions of management psychology. Psychology of managerial communication. Psychological characteristics of the staff. Psychology of employee motivation. Technologies of human resource management of the organization. Psychological support of personnel policy of the organization. Psychology of conflict in the</p>	4			v	v					v

				organization. Technologies for preventing professional deformation of personality. Management consulting.										
Module of Methodical Bases of Teaching	BD	HSC	Higher School Pedagogy	<p>Goal: Formation of skills in planning and organizing the educational and scientific process based on the principles of student-oriented learning and assessment, extrapolating innovative and practice-oriented teaching methods and technologies into the educational process.</p> <p>Contents: Methodology of higher education pedagogy. Modern global trends in the development of higher education. History, current state and prospects for the development of higher education in Kazakhstan. Didactics of higher education. Student-centered learning and assessment in higher education, its patterns and principles. Contents of education, innovative pedagogical technologies, forms and methods of teaching in higher education institutions. Concepts, strategies, mechanisms for promoting global and national values among students and in society.</p>	4		v	v	v					
	PD	HSC	Teaching Methods of Special Disciplines	<p>Goal: Formation of modern complex methodological, research, creative thinking of a teacher of chemical engineering disciplines in higher education.</p> <p>Contents: Application of modern technologies of teaching, learning, digital technologies in professional activities.</p>	5		v	v	v					

				Ensuring the safety and well-being of students, creating motivation for learning. Training in teaching specialized disciplines by analyzing and solving problem situations, drawing up a group project, and conducting role games. Allows to acquire skills in modern research and development in the field of education and attract students to research.										
			Pedagogical Practice	<p>Goal: Formation of professional skills of a teacher of higher education; mastering the bases of pedagogical skills, the skills of independent conduct of educational work.</p> <p>Contents: Development of pedagogical skills in the field of chemical technology of inorganic substances, culture of scientific and pedagogical thinking. Development of educational and methodical documents on the discipline. Preparation for classes and conducting practical and laboratory classes in special disciplines of undergraduate studies. Development of new active forms of conducting classes and their application in practical classes.</p>	4		v	v	v					v
Module of Research Methodology	PD	EC	Designing Chemical Productions	<p>Goal: Formation of competencies in the field of chemical production design, analysis of modern technological schemes and feasibility study of production.</p> <p>Contents: Organization of chemical production design. Design and estimate</p>	4	v					v		v	

			documentation. Initial data, stages of designing equipment and enterprises for production of phosphorus, ammonia, inorganic acids, salts and mineral fertilizers. Automated design systems. Development of the technological scheme of production. Calculation of process mass and heat balances. Technological and mechanical calculation of main and auxiliary equipment of chemical industries.											
PD	EC	Statistical Methods for Processing Scientific Data	<p>Goal: Formation of skills for independent calculation of process statistical indicators and derivation of regression equations.</p> <p>Contents: Basic concepts of probability theory, statistical methods for experimental data analysis, numerical characteristics of a random variable, basic standard distributions of a random variable. Teaching dispersion analysis, correlation and regression analysis, time series analysis. One-factor, curvilinear and multivariate correlation coefficients. Mastery skills to independently process experimental data using mathematical statistical programs and databases.</p>								v	v		
BD	EC	Methods of Inorganic Compounds Research	<p>Goal: Mastering the methods of studying inorganic compounds</p> <p>Contents: Theoretical and experimental research methods, stages of planning and implementation of inorganic compounds' research individually and in a team; methodology for analyzing scientific</p>	4	v	v					v	v		

			information in electronic databases, formulating the task of scientific research. Mastering the methodology of an experiment, methods and means of measurement, methods of processing the results of measurements and observations.											
BD	EC	Physico-Chemical Analysis of Inorganic Substances	<p>Goal: Analysis of inorganic substances and compounds by instrumental physico-chemical methods.</p> <p>Contents: Methods of analysis of inorganic compounds: X-ray phase, spectrophotometric, atomic absorption, optical infrared microscopy. Structure and principle of operation of applied devices. Formation of skills to identify chemical and mineralogical composition of inorganic substances under study, to determine the structure and morphology of inorganic materials, specific surface and an average particle size of the dispersed material.</p>								v	v		
		Research Practice	<p>Goal: Acquaintance with the latest theoretical, methodological and technological achievements of domestic and foreign science, with modern methods of scientific research.</p> <p>Contents: Practical studying the latest achievements of domestic and foreign science: analysis of the state of chemical technology development; role of science and innovation in the technology improvement and modernization; mastering the modern methodology of</p>	6	v	v				v	v			

				scientific research and the ability to apply it when working on the chosen topic of the master's thesis; preparation and conduct of a scientific experiment.										
Scientific and Technological Module	BD	EC	Graphic Analysis of Processes in Multicomponent Systems	<p>Goal: Mastering the methods of graphic calculations of phase conversions in multicomponent water-salt systems with the use of solubility diagrams.</p> <p>Contents: Application of graphic analysis of multicomponent systems in technological calculations of inorganic salt productions to select optimal conditions of processing mineral raw materials. Formation of skills of calculating processes of evaporation, dissolution and crystallization based on phase equilibria in ternary and quaternary systems using solubility diagrams. Compiling the mass balance of processes, calculating the product output and determining the technological mode for mineral fertilizer production. Applying knowledge and skills in interdisciplinary scientific research.</p>	5					v	v		v	v
	BD	EC	Study of thermodynamics and kinetics of technological processes	<p>Goal: Formation of the ability to calculate and analyze the thermodynamic and kinetic regularities of chemical technological processes.</p> <p>Contents: Theoretical foundations of chemical kinetics, various methods for calculating the rate constant, activation energy and reaction order to determine the region of the technological process behavior. Selection of various models for</p>							v		v	v

			kinetic analysis of various types of processes under various conditions. Analysis of the thermodynamic probability of chemical processes occurring under various technological parameters. Instilling skills in calculating isobar-isothermal potential, equilibrium constant and equilibrium product output to determine the optimal technological mode.											
PD	EC	Modern Construction Materials in Chemical Technology	<p>Goal: Study of characteristics and methods of protection of modern structural materials from corrosion.</p> <p>Contents: Advanced construction materials used in mineral salts' production, their corrosion resistance, modern ideas about regularities and mechanisms of destruction of construction materials in the technology of inorganic compounds, metallic and non-metallic protective coatings. New methods of equipment protection against corrosion, application of electrochemical cathodic and anodic protection, corrosion inhibitors in scientific research.</p>	6						v	v			
PD	EC	Physical Chemistry of Surfaces	<p>Goal: Study of theoretical foundations of phenomena at the interface.</p> <p>Contents: Theory of capillary phenomena, thermodynamics of liquid phase interfaces in liquid-liquid and liquid-solid systems, theoretical estimates of surface energy and free surface energy, regularities and phenomena manifested by nano-</p>						v	v				

			dispersed colloid systems. Teaching the skills of practical application of surface physical chemistry provisions in technologies of new materials and interdisciplinary scientific fields.											
PD	EC	Adsorption processes in inorganic technology	<p>Goal: Formation of knowledge of adsorption processes' regularities.</p> <p>Contents: Regularities of adsorption processes at interface boundaries, Langmuir's monomolecular theory of adsorption: statics and kinetics of adsorption and desorption, thermodynamic characteristics of adsorption, adsorption at solid-gas, solid-liquid interfaces. Formation of knowledge on the most effective industrial adsorbents, types and constructions of adsorbers used to clean exhaust gases from productions of inorganic substances, acids and fertilizers.</p>	5					v	v				
PD	EC	Technology of Inorganic Polymers	<p>Goal: Formation of knowledge in the field of high-temperature processes for production of inorganic polymers.</p> <p>Contents: Microstructure and properties of inorganic polymeric materials, ability of elements to form homochromatic and heterochain polymers, methods for producing inorganic polymers by polycondensation and polymerization of monomers. Formation of deep knowledge of high-temperature technologies of inorganic carbon-, aluminum-, boron-containing polymeric</p>		v							v		

				materials and ability to obtain them in laboratory conditions.										
	PD	EC	Innovative Feed Salt Technologies	<p>Goal: Formation of knowledge and skills in the field of modern technologies of feed salts.</p> <p>Contents: Deepening knowledge about new cost-effective methods for production of feed mineral products, standard requirements for composition. Selection of optimal technological modes for productions of condensed and thermal defluorinated phosphates, feed monocalcium phosphate, precipitate, diammonium phosphate, disodium phosphate. Management of the process of obtaining feed phosphates from different types of raw materials. Analysis of results of calculating the indicators of obtaining feed salts based on solubility diagrams.</p>	5	v				v	v		v	
	PD	EC	Mathematic Planning and Processing Experimental Results	<p>Goal: Formation of skills for independent planning of an experiment and modeling of its results.</p> <p>Contents: Stages of planning and conducting scientific research, deepening knowledge of features of conducting scientific experiment to predict, search for optimal solutions and modes for functional control of the studied object. Formation of skills that allow to independently carry out computer modeling of an object under study, form target function and using adaptive control methods to conduct multi-criteria</p>								v	v	

				optimization of experimental research object.										
Industrial Chemical Module	BD	EC	Energy Efficient Technologies of Mineral Acids	<p>Goal: Formation of knowledge and skills in the field of modern energy-saving technologies of mineral acids.</p> <p>Contents: Prospects for development of energy-technology and resource-saving schemes for production of sulfuric, nitric, hydrochloric, wet and dry phosphoric acids, synthetic ammonia. Deepening knowledge about methods of chemical reaction heat utilization, the use of intensive energy-chemical units, rational instrumentation of processes. Organization of effective control of a technological process, formation of skills of making operational decisions in energy efficient productions and performing technological calculations of energy saving.</p>	6				v	v	v		v	
	BD	EC	Advanced Soda Ash Technologies	<p>Goal: Formation of skills for choosing optimal technological mode of modern soda ash production.</p> <p>Contents: Features of modern soda ash production by the Solvay method: justification for the need to clean raw brine, promising schemes for operation of an absorption column, justification of temperature-concentration mode of ammoniated brine carbonization, optimal mode of sodium bicarbonate calcination. Formation of skills for solving problematic issues of ammonia regeneration, distilled waste utilization,</p>						v	v		v	

				performance of technological calculations of production.										
PD	EC	Resource Saving Technologies of Technogenic Waste Processing	<p>Goal: Formation of ideas about modern methods of processing and disposal of technogenic waste and organization of waste-free technology.</p> <p>Contents: Directions for creating resource-saving waste-free and low-waste mineral fertilizer technology, methods for storing and disposing of chemical plant waste, an integrated technology for recycling waste of phosphorus, wet-process phosphoric acid and phosphate fertilizers. Mastering the methods of utilization of solid industrial waste, treatment of sewage and gaseous emissions from production of mineral fertilizers and methods of their regeneration.</p>	5					v	v				
PD	EC	Environmental Risk Management	<p>Goal: To study ways to solve environmental problems in chemical engineering and assess the environmental safety of chemical productions.</p> <p>Contents: Formation of skills for assessing the degree of influence of factors on the value of environmental risk, methods for analyzing technogenic risk, reducing the risk degree, structure and value of possible damage. Acquisition of skills in calculating the damage from environmental pollution by industrial waste from productions of inorganic compounds, economic damage from technogenic accidents and</p>						v	v		v		

			emergencies.											
	PD	EC	Innovative Technologies of Available Phosphates and Nitrates	<p>Goal: Formation of skills for analyzing the technologies of available phosphates and nitrates and making practical decisions to improve technological processes.</p> <p>Contents: Deepening the knowledge of features of substandard phosphate raw materials decomposition with an acid, modern methods for production of ammophos, dicalcium phosphate, ammoniated double superphosphate, ammonium nitrate, potassium nitrate and ammonium sulfate. Justification of the choice of a rational technological scheme. Formation of skills for calculating the processes of obtaining nitrogen and phosphorus fertilizers.</p>	6				v		v		v	
	PD	EC	Chemical Technology of Reactive Acids and Salts	<p>Goal: Study of scientific foundations and technological modes for production of reactive acids and salts.</p> <p>Contents: Methods of obtaining high-purity substances, modern technological schemes for production of reactive acids and salts. The effect of pollution on processes of substance deep purification. Ways to modernize the production of reactive phosphoric acid of “pure”, “analytically pure” and “chemically pure” grades. Methods for obtaining salts of food and reactive qualifications. Analysis of main stages’ calculation and substantiation of production optimal conditions.</p>							v		v	

	PD	EC	Development Prospects of Complex Mineral Fertilizer Production	<p>Goal: To study scientific foundations of fertilizer mixing and production of complex and complex-mixed mineral fertilizers.</p> <p>Contents: Deepening knowledge about new methods of producing complex-mixed mineral fertilizers from poor phosphate raw materials, about development of new compositions of fertilizer mixtures, about features of the production of complex fertilizers of prolonged action with the use of technogenic waste with microelements. Organization of operational dispatch control of NP, NPK and PK fertilizers and fertilizer mixtures production.</p>	5					v	v			
	PD	EC	Modern Technologies of Processing Mineral Raw Materials	<p>Goal: Formation of fundamental knowledge in the field of modern technologies for processing of mineral raw materials and technogenic waste.</p> <p>Contents: Features of modern technologies of chemical, electrothermal and extraction processing of mineral raw materials using industrial waste. The relevance of the problem of mineral raw materials' integrated use; new technologies for mineral enrichment. Selection of optimal technological mode of production, indicators of processing processes. Calculation of the efficiency of chemical-technological processes using mathematical modeling programs.</p>		v					v		v	
	PD	EC	Actual Problems of	<p>Goal: Formation of knowledge among master students about modern problems</p>	6						v	v	v	

		Electrochemical Technology	<p>of electrochemical technologies and ways to solve them.</p> <p>Contents: Environmental problems of electrochemical productions. Environmental hazard of technological solutions and ways to reduce it. Principal schemes for purification of wash and waste waters, their comparative characteristics. Electrochemical methods of sewage treatment, regeneration of waste electrolytes. Local cleaning schemes. Principles for adapting electroplating production and sewage treatment systems. Recycling of sludge from galvanic production and electrochemical processing. Formation of skills for producing electrochemical coatings in various ways and calculating indicators of electrochemical processes.</p>											
PD	EC	Functional Electroplating	<p>Goal: Formation of knowledge about regularities of applying metal coatings by electrochemical method; ways to give them the desired properties; methods of quality control of galvanic coatings.</p> <p>Contents: Purpose and types of electrochemical coatings. Coating methods. Modern requirements for special properties of coatings: physical-mechanical, physical, physical-chemical ones. Features of formation of electrolytic deposits. Functional properties of galvanic coatings. Investigation of processes of applying galvanic coatings with desired properties</p>					v	v					

				and analysis of the influence of deposition conditions on the deposits' quality.										
Module of research work and Final Attestation			Research Work of a Master Student, including Passing an Internship and Completing a Master's Thesis	<p>Goal: Formation of skills of analytical review of ways to obtain inorganic compounds in electronic databases with the use of information technologies. Performing experimental research work using the instrumental base based on methodology of scientific research.</p> <p>Contents: Formation of skills for interpreting the obtained scientific results and mathematical processing of new data, substantiating the technological scheme of production, determining the economic efficiency of the developed technology, making conclusions.</p>	24	v	v				v	v	v	v
			Execution and Defense of Master's Thesis	<p>Goal: Evaluation of learning outcomes and key competencies achieved upon completion of the master's degree program.</p> <p>Contents: Formation of skills of summarizing the results of independent research by a master student of one of the urgent problems of the specialty, interpretation and substantiation of scientific research results and presenting them in the form of a master's thesis and defense to a wider audience.</p>	8	v	v				v	v	v	v

5 SUMMARY TABLE REFLECTING THE VOLUME OF MASTERED CREDITS BROKEN DOWN THE EP MODULES

Year of training	Semester	Number of mastered modules	Number of studied disciplines		Number of KZ credits					Total hours	Total KZ credits	Number of	
			HS C	EC	Theoretical training	Pedagogical practice	Research practice	MSR W	Final attestation			exam	dif.credit
1	1	3	5	2	29			1		900	30	6	1
	2	2	-	4	22	4		4		900	30	4	2
2	3	2	-	4	11		6	3		600	20	2	1
	4	2			16			4		600	20	3	0
	5							12	8	600	20	0	1
Total			5	10	78	4	6	24	8	3600	120		

6 STRATEGIES, TEACHING METHODS AND ARTIFICIAL INTELLIGENCE, MONITORING AND ASSESSMENT

Training strategies	<p>Student-centred teaching: The student is the centre of teaching and an active participant in the learning and decision-making process.</p> <p>Practice-oriented teaching: the focus is on the development of practical skills.</p>
Teaching methods	<p>Conducting lectures, seminars, various types of practical classes with:</p> <p>Using innovative technologies:</p> <ul style="list-style-type: none"> • problem-based learning; • casestudies; • group work and creative groups; • discussions and dialogues, intellectual games, Olympiads, quizzes; • reflection methods, projects, benchmarking; • presentations; <p>Rational and creative use of information sources:</p> <ul style="list-style-type: none"> • multimedia training programmes; • electronic textbooks; • digital resources; • machine learning methods. <p>Organization of students' independent work, individual consultations.</p>
Monitoring and the attainability of learning outcomes	<p>Current control on each topic of the discipline, knowledge control in the classroom and out-of-class activities (<i>according to the syllabus</i>). Forms of assessment:</p> <ul style="list-style-type: none"> • questioning in class; • defence of independent works; • discussions; • trainings; • colloquia;

	<ul style="list-style-type: none"> • projects; • analytical reviews. <p>The mid-term assessment shall be carried out in accordance with the syllabus and academic calendar.</p> <p>Intermediate attestation is carried out in accordance with the working curriculum, academic calendar.</p> <p>The forms of conducting: exam in the form of testing; oral exam; written exam; combined examination; attestation on SRWM; defense of the practice and internship reports.</p> <p>The final state attestation is defense of a master thesis.</p>
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7 EDUCATIONAL AND RESOURCE SUPPORT FOR EP

<p>Information and Resource Centre</p>	<p>The structure of the Educational Information Center (EIC) includes 6 subscriptions, 16 reading rooms, 2 electronic resource centres (ERC). The basis of the network infrastructure of the EIC consists of 180 computers with Internet access, 110 automated workstations, 6 interactive whiteboards, 2 video decks, 1 video conferencing system, 3 A-4 scanners, 3. The EIC software is IRBIS-64 under MSWindows (basic set of 6 modules), an autonomic server for uninterrupted work in the IRBIS system.</p> <p>The library collection is reflected in the electronic catalogue, which can be accessed online 24/7 at http://lib.ukgu.kz.</p> <p>Thematic databases of own generation were created: "Almamater", "Proceedings of SKSU scientists", "Electronic Archive". Online access from any device in 24/7 mode by external link http://articles.ukgu.kz/ru/pps.</p> <p>Work with catalogues in electronic form. The EC consists of 9 databases: "Books", "Articles", "Periodicals", "Proceedings of SKSU staff", "Rare books", "Electronic collection", "SKSU in press", "Readers" "SKR".</p> <p>The EIC provides its users with three options for accessing its own electronic information resources: from the "Electronic Catalogue" terminals in the catalogue hall and departments of the EIC; via the university information network for faculties and departments; and remotely on the library's website http://lib.ukgu.kz/.</p> <p>Access to international and national resources is open: "SpringerLink", "Polpred", "Web of Science", "EBSCO", "Epigraph", to electronic versions of scientific journals in open access, "Zan", "RMEB", "Adebiet", Digital Library "Aknurpress", "Smart-Kitap", "Kitap.kz", etc.</p> <p>For people <i>with special needs and disabilities</i>, the EIC has adapted the library website for visually impaired users.</p>
<p>Material and technical</p>	<p>The material and technical base of the Chair of TI&PCP includes the following classrooms and laboratories for master students:</p>

base	<ul style="list-style-type: none">• Laboratory of cooperation of LLP "Kazphosphate" and the chair - 126AB,• Scientific laboratory for master students - 320A;• Scientific laboratory for master and doctoral students -331A• Lecture rooms with interactive whiteboard - 320A, 330A, 323A. <p>Master students use the services of common laboratories of Regional Testing Laboratory of Engineering Profile "Structural and Biochemical Materials" (IRLIP "KBM") and SAPA to perform chemical and physico-chemical analysis.</p>
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AGREEMENT SHEET
on the Educational program
7M07162 - «Chemical technology of inorganic substances»

Director of PGEI	_____	Yelibayeva G.I.
Director of DASc	_____	Nazarbek U. B.
Director of DE&C	_____	Bazhirov T. S.

Review
for the Master degree program "Chemical technology of inorganic substances" developed by the department of "Chemical technology of inorganic substances" at M.AuezovSKSU

The Master's degree programme "Chemical technology of inorganic substances" by name and code corresponds to the classifier of specialties of higher and postgraduate education of the Republic of Kazakhstan. The program is developed on the basis of a system of professional competencies, ensuring the unity of theoretical and practical readiness of a specialist to carry out professional activities, fully complies with Level 7 of the National Qualifications Framework of the Republic of Kazakhstan. At the same time, the developed learning outcomes take into account the interests of all regional participants and contribute to the training of specialists with in-depth professional knowledge in the field of chemical technology of inorganic substances.

The scientific-pedagogical profile of the programme enables graduates to engage in the following professional activities:

- Pedagogical and educational practice;
- Conducting research and experimental work in the field of chemical and inorganic substance technology;

And work in:

- government and non-government educational institutions;
- Research and design institutes;
- Research and production associations;

The curriculum offers students a sufficient number of elective modules to facilitate the development of an individual learning pathway. The structure of the programme is reflected in the curriculum and includes basic and vocational modules, practice modules and final attestation.

The structure of the plan as a whole is logical and consistent. Assessment of the annotated work programmes of academic disciplines allows to conclude that the content of the modules corresponds to the system of professional competencies, ensuring the unity of theoretical and practical readiness of the specialist to carry out professional activities.

The modules included in the curriculum reveal the essence of the current problems in the field of chemical technology of inorganic substances. The quality of the content component of the curriculum does not raise any doubts.

In order to consolidate theoretical knowledge and practical skills, the curriculum provides for various types of internships at leading enterprises and organisations in Kazakhstan.

The work programmes of the educational programme clearly demonstrate the use of active and interactive forms of classes, including group projects, discussions, business games, case studies, etc.

In the development of assessment tools for quality control of the modules, all kinds of links between the included knowledge, skills, and abilities are taken into account to determine the quality of the formed competencies of students by type of activity and the degree of overall readiness of graduates for professional activities.

The programme is one of the advantages of taking into account the requirements of employers in the formation of modules of the professional cycle.

In general, the reviewed educational programme developed and implemented at M.Auezov SKSU contributes to the achievement of the planned objectives and their learning outcomes, the formation of general cultural and professional competencies, and therefore can be recommended for use in the educational process.

Expert:

Director of MFP LLP «Kazphosphate»

Isayev T.A.

Expert opinion
on the educational programme
7M07162-Chemical technology of inorganic substances,
developed at M.Auezov SKSU, Shymkent

The relevance and demand for the EP. As part of the process of Kazakhstan's entry into the European educational space, the development of the educational programme 7M07162-“Chemical technology of inorganic substances” is relevant. The content of the educational program "Chemical technology of inorganic substances" corresponds to Level 7 of the National Qualification Framework of the Republic of Kazakhstan; it is also harmonized with the Dublin descriptors, cycle 2 of the Qualification Framework of the European Higher Education Area, as well as with Level 7 of the European Qualification Framework for Lifelong Learning. The relevance of the educational programme "Chemical Engineering of Inorganic Substances" is determined by its aim to train academic staff with advanced knowledge, creativity in professional activities, able to work in national and international teams and mastering the strategy of lifelong learning.

Learning outcomes and competencies, their connection with the labor market demands. Learning outcomes contribute to the formation of professional knowledge in the main areas of scientific and pedagogical training for practical application aimed at the development of mineral raw materials processing technology, the use of information to solve problems in the field of chemical technology of inorganic substances, the ability to describe the theoretical regularities of technological processes of mineral raw materials and technogenic waste with the production of inorganic compounds. The graduates are employed at enterprises producing inorganic compounds, higher education institutions and research and designing institutes.

The availability of components which develop practical skills. The curriculum contains modules that are essential for the development of professional skills in organisational and managerial, industrial and technological, design engineering, research and pedagogical activities. These include generic and interdisciplinary modules that include modules on scientific-pedagogical training and teaching and research methodology.

The content of the educational programme. The educational programme "Chemical technology of inorganic substances" also includes scientific and technological, industrial chemical and module of professional competence development. Upon successful completion of these modules a graduate is able to apply educational potential, acquired knowledge and experience in professional activities to analyse and solve non-standard problem situations; able to manage chemical and technological processes, develop new methods of production and test them in production conditions, conduct detailed analysis of scientific and technical

information in the field of chemical technology of inorganic compounds for the purpose of scientific, patent and marketing support of conducted scientific research.

Educational programme "Chemical technology of inorganic substances" contains a description of each discipline with detailed data on the module level, the discipline cycle, the main provisions considered, their specificity, the skills and abilities to be formed. A set of elective disciplines offered for the choice of a master's study pathway is presented. Each module of the educational programme is focused on the achievement of certain learning outcomes.

Based on the above, it follows that the educational programme of Master degree 7M07162 - Chemical technology of inorganic substances, meets the requirements and is recommended for the organization of the educational process of Master level 7 of the National Qualifications Framework of the Republic of Kazakhstan.

Chairman of the Expert
Committee, d.t.s., Dean of the
Higher School

Anarbayev A.A.

"ChE and BT"

Members of the Expert
Committee:

Karatayeva G.E.

C.t.s., docent

C.t.s., docent

Dubinina Ye.S.

Senior lecturer

Mamytova G.Zh.

