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MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE REPUBLIC
OF KAZAKHSTAN

M.Auezov SOUTH KAZAKHSTAN UNIVERSITY



«APPROVED»
Chair of the Board of Rector
d.h.s., academician Kozhamzharova D.P.
«23» 02 2023

EDUCATIONAL PROGRAM

7M07163 - Technology of mineral salts and agrochemistry

Registration number	7M07100401
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	M097-Chemical engineering and processes
Type of EP	Innovative
ISCE level	7
NQF level	7
SQF of education level	7
Language of learning	English, Russian, Kazakh
The complexity of the EP, not less	120 credits
Distinctive features of EP	-
University Partner (JEP)	-
University Partner (DDEP)	-

Shymkent, 2023

Authors:

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The EP was considered at the meeting of the Academic Committee in the direction of training "Engineering and engineering business", Minutes № 4 from « 24 » 01 2023

Chairman of Academic Committee Aitureyev M.Zh.

The EP was considered and recommended for approval at the meeting of Education and Methodical Council of M. Auezov SKU.

Minutes № 4 " 22 " 02 / 2023.

Chairman of EMC Abisheva R.Zh.

Approved by the decision of the Academic Council of the University
Minutes № 13 from 23.02 2023.

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« ___ » _____ 2023

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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.
Uniqueness of the EP	EP is an interdisciplinary one; it is aimed at training masters of technical sciences with integrated knowledge and skills in the fields of both production and use of fertilizers for agricultural crops, production and control of the feed use in Livestock production, organization and improvement of agrochemical measures and chemical expertise of agrochemical products, as well as in scientific and pedagogical sphere.
Academic Integrity and Ethics Policy	<p>The university has taken measures to maintain academic honesty and academic freedom, protection from any kind of intolerance and discrimination:</p> <ul style="list-style-type: none"> • Rules of academic integrity (Order No. 212-ҢҚ dated 10.10.2022); • Anti-Corruption Standard (Order No. 221-ҢҚ dated 07.12.2021). • Code of Ethics (order No. 212-ҢҚ dated 10.10.2022). • Anti-Corruption Policy of the NJSC “M. Auezov South Kazakhstan University.” (order No. 144 нқ dated 07.14.2022).
Legal framework for EP development	<ol style="list-style-type: none"> 1. Law of the Republic of Kazakhstan "On Education" No. 319-III dated July 27, 2007; 2. Standard rules of activity 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 3. State obligatory standards of higher and postgraduate education, approved by order of the Ministry of Education and Science of the Republic of Kazakhstan dated July 20.2022 No. 2; 4. Rules for educational process organization on credit training technology, approved by an order of the Minister of Education and Science of the RK on April 20, 2011 No. 152; 5. “Qualification directory of positions of heads, specialists and other employees” approved by an order of a Minister of Labour and Social

	<p>Protection of population of the RK (order № 553 of December, 30, 2020);</p> <p>6. Guidelines for the use of ECTS;</p> <p>7. Guidelines for development of educational programs for higher and postgraduate education, Appendix 1 to an order of the director of CBP&AM No. 45 o / d dated June 30, 2021.</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>Set according to Standard Rules for admission to training in educational organizations realizing educational programs of higher and postgraduate education (order of MES RK №600 of 31.10.2018).</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 in-demand scientific and pedagogical personnel with integrated knowledge and skills in technology of inorganic compounds and agrochemistry for the system of higher education and scientific-and-industrial 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 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; • 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; • providing training of specialists capable of organizing the production and use of mineral fertilizers, carrying out scientific research and scientifically substantiating the choice of types and forms of fertilizers and effective feedstuff; • formation of graduates' competitiveness in the field of chemical technology and agriculture to provide employment opportunities in the training direction or continuing education in doctoral studies.
EP harmonization	<ul style="list-style-type: none"> • Dublin descriptors of the 7th level of Qualifications; • the 7th level of the National Qualifications Framework of the Republic of Kazakhstan; • the 2nd cycle of the Qualification Framework of the European Higher Education Area; • the 7th level of the European Qualification Framework for Lifelong Learning
EP communication with the professional sphere	<ul style="list-style-type: none"> • Industry qualifications framework “Chemical production” (Appendix No. 2 approved by the minutes of 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 "16" August 2016, № 1); • Industry qualifications framework “Agriculture” approved by the minutes of the branch tripartite commission on social partnership and regulation of social and labor relations with amendments and additions dated July 1, 2019; • Professional standard "Feed production for farm animals" (Appendix No. 8 to the order of the Deputy Chairman of the Board of the “Atameken” National Chamber of Entrepreneurs of the Republic of Kazakhstan dated October 26, 2022, No. 190).
Name of the degree awarded	After successful completion of this EP, the graduate is awarded the degree of “Master of Technical Sciences” of the educational program “7M07163 - Technology of Mineral Salts and Agrochemistry”
List of qualifications and positions	<ul style="list-style-type: none"> • Development Director • Inorganic Production Technologist • Head of Laboratory (in agriculture) • Chief Agronomist for Plant Protection

	<ul style="list-style-type: none"> • Chemical Engineer in Research Institutes • Teacher at higher educational institutions
Professional area	<ul style="list-style-type: none"> • Industrial enterprises for the production of mineral fertilizers and feedstuff; • higher education institutions • research institutes, • research and production centers of the Ministry of Agriculture of RK; • republican, regional and district centers "Agrochemical service"; • farms and peasant farms.
Objects of professional activity	<ul style="list-style-type: none"> • chemical technology of mineral fertilizers; • soil and plants; • feed salt technology; • plant protection products and chemical ameliorants; • methods of using fertilizers and plant protection products; • management of primary labor collectives; • methods and devices for the research of inorganic compounds; • education; • educational and methodical documentation, technical means of training; • research work.
Subjects of professional activity	<ul style="list-style-type: none"> • analysis of mineral salts, soils and plants; • research of processes of obtaining new types of fertilizers and feed salts; • quality control of mineral fertilizers and feedstuff; • improvement of chemical-and-technological processes; • reproduction and preservation of soil fertility; • analysis and solution of problematic industrial situations; • optimization of mineral nutrition of plants; • use of means of chemicalization, soil reclamation activities; • testing of innovative technologies for obtaining and using fertilizers; • teaching specialized disciplines in chemical engineering and agrochemistry; • education of students.
Kinds of professional activity	<ul style="list-style-type: none"> • organizational-and-managerial; • production-and-technological; • design-and-construction; • scientific research; • pedagogical.
Learning outcomes	<p>LO1 Systematize and critically analyze scientific and technical information using knowledge of a foreign language and research results with the involvement of information resources and mathematical processing of experimental data.</p> <p>LO2 Analyze ideological and methodological problems, including interdisciplinary ones, based on provisions of the philosophy of science and methodology of scientific research.</p> <p>LO3 Effectively manage a team using psychological and pedagogical technologies and modern teaching methods in higher education, showing leadership qualities, creative approach and logical thinking.</p> <p>LO4 Make operational managerial and technical decisions in non-standard situations, independently managing the production process of obtaining and application of mineral fertilizers, feed salts and plant protection products.</p>

LO5 Justify optimal technological mode for mineral salts' production based on regularities of chemical-technological processes for obtaining high-quality products.

LO6 Offer effective systems of mineral fertilizers depending on the nutrient availability in the soil.

LO7 Evaluate and prove the results of scientific research in domestic and international scientific environment, summarizing the research results in scientific papers taking into account principles of scientific ethics.

LO8 Solve the problems of rational use of fertilizers in various farming systems, taking into account agricultural practices, soil and climatic conditions and biological features of crops within framework of the program of automation and digitalization of agriculture.

LO9 Integrate and develop research, entrepreneurial and uncertainty skills to analyze problems in interdisciplinary related fields of knowledge and continuous personal development.

3 COMPETENCES OF A GRADUATE OF THE EDUCATION PROGRAM

GENERAL COMPETENCES (SOFTSKILLS): Behavioural skills and personality skills	
GC1. Competence in managing their own literacy (self-learning and systems thinking; transdisciplinarity and cross-functionality)	GC1.1 Strive for lifelong professional and personal growth. GC1.2. To continually update and deepen knowledge in the chosen pathway and in an interdisciplinary environment, with a high degree of independence. GC1.3. To be capable of reflection, objective assessment of own achievements, awareness of the need to form new competencies during doctoral studies.
GC2. Language competence	GC2.1. 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. GC2.2. Skill in mediation and intercultural understanding in an international environment.
GC3. Mathematical and scientific competence	GC 3.1. Ability to interpret methods of mathematical analysis and modelling to solve applied problems in the field of study. 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. GC 3.3. Ability to analyse and comprehend modern methods of pedagogical and psychological science and to apply them in pedagogical activities.
GC4. Digital competence, technological literacy	GC 4.1. The ability to confidently use modern information and digital technology, artificial intelligence systems for work, leisure and communication. GC 4.2. Proficiency in the use, recovery, evaluation, storage, production, presentation and exchange of information across a wide range of digital devices. GC 4.3. The ability to confidently use global information resources and apply technological literacy to research and computational and analytical activities.
GC5. 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.
GC6. 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.
GC7. Cultural awareness and ability to express oneself	GC 7.1. The ability to demonstrate a general outlook, civic and moral position. GC7.2. The ability to be tolerant of the traditions and culture of the peoples of the world, with high spiritual qualities.

PROFESSIONAL COMPETENCES (HARDSKILLS) Theoretical knowledge and practical skills specific to the field of study	
PC1. Research	<p>PC 1. The ability to master chemical and agrochemical methods of analysis, effective methods of application of mineral fertilizers, fodder salts and plant protection products, to develop new methods of their production and to test them under production conditions;</p> <p>PC1.2. The ability to organise and conduct research work in the field of mineral salt technology and agrochemistry, to carry out experiments and summarise the results of research work in the form of scientific publications, to defend his/her position in discussions and to make professional decisions under conditions of uncertainty and risk;</p>
PC2. Methodological	<p>PC2.1. Ability to carry out detailed analysis of scientific and technical information in the field of chemical technology of mineral fertilizers, feed and plant protection products, rational use of land resources and soil fertility improvement for the purpose of scientific, patent and marketing support of scientific research carried out;</p> <p>PC2.2. Ability to analyse and comprehend the realities of modern theory and practice on the basis of the methodology of scientific knowledge, to apply new methods of teaching specialist disciplines in pedagogical activity.</p>

3.1 Matrix of correlation of EP learning outcomes in general with modules formed by competencies

	LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	LO9
GC1			+						+
GC2		+					+		
GC3	+					+		+	
GC4	+						+	+	
GC5	+		+	+					
GC6			+	+	+	+			+
GC7		+	+						
PC1	+				+		+		+
PC2		+	+				+	+	

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

Module name	Cycle	UC/EC	Component Name	Brief discipline description (30-50 words)	Number 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 on further development of skills</p>	4	v						v		v	

			<p>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 organization. Technologies for</p>	4		v	v	v					v

				preventing professional deformation of personality. Management consulting.										
Module of Methodical Bases of Teaching	BD	HSC	Higher School Pedagogy	<p>Goal: Formation of foundations of the professional and pedagogical culture of a university teacher, general pedagogical competencies, familiarization with theoretical and methodological foundations of higher education pedagogy, technologies for planning, organizing and managing the educational process at a university.</p> <p>Contents: Modern paradigms of education, history and latest trends in the development of higher professional education in the world and in Kazakhstan. Genesis and methodology of pedagogy of higher education, the competence of a university teacher. Problems of university didactics, problems of organizing educational work with students. Modern approaches and methods of teaching and organization of educational activities of students, evaluation of educational achievements.</p>	4		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: Modern pedagogical technologies in the activity of a teacher of specialized disciplines. Methodology for designing and conducting classes. Application of individual, integrated and multimedia</p>	5		v	v	v					

				learning technologies. Teaching profile disciplines by analyzing and solving problem situations, drawing up a group project. Organization of the academic process and scientific work of students. Development of educational and methodical documentation, didactic teaching aids, control and measuring materials for intermediate and final control.										
			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
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 documentation. Initial data,</p>	4	v			v	v				

			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;</p>	4	v	v						v	

			methodology for analyzing scientific 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	Methods of Agrochemical Research	<p>Goal: Studying regularities of migration of chemical elements in soil-plant-fertilizer system.</p> <p>Contents: Analytical methods for studying plants and soil. Planning and organizing a field trial and applying its results to calculate soil and fertilizer nutrient utilization coefficient. Principles of compiling multifactorial field experiments, ways to reduce multivariate schemes. Formation of analysis skills used in agrochemical research, mathematical processing of research results.</p>		v					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</p>	6	v	v			v	v	v	

				methodology of 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 in ternary and quaternary systems using solubility diagrams, compiling the mass balance of processes, applying knowledge and skills in interdisciplinary scientific research.</p>	5	v			v					v
	BD	EC	Advanced studies of Phase Equilibria in Multicomponent Systems	<p>Goal: Acquisition of skills in research of processes of dissolution and crystallization of mineral salts based on phase equilibria in multicomponent systems.</p> <p>Contents: Kinetic regularities and methods of accelerating the processes of dissolution and crystallization from solutions, methods of obtaining large crystals and purifying solutions from impurities. Application of solubility diagrams of multicomponent systems for calculating the product output and</p>		v			v					v

			determining the technological mode for mineral fertilizer production. Application of calculation skills in scientific research.											
	PD	EC	Innovative Technologies in Agrochemistry	<p>Goal: Studying main directions of developing innovations in the field of agrochemistry and soil science.</p> <p>Contents: Methods for determining needs of plants in macro- and microelements and influence of nutritional conditions on plant metabolism. Formation of skills for calculating and optimizing fertilizer doses, differentiated application of chemicals using digital technologies. Methodological approaches to modeling and designing agroecosystems, optimizing soil conditions, reproducing soil fertility and fertilization systems.</p>	5	v						v		v
	PD	EC	Mathematical Planning and Processing the 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</p>		v	v		v					

			multi-criteria optimization of experimental research object.											
PD	EC	Agroecological Assessment of Soils	<p>Goal: Studying soil-agro-climatic resources of ecosystems.</p> <p>Contents: Level of potential bioproductivity as a factor in choosing optimal use of soils, criteria for environmental assessment and decrease in fertility as a factor in soil degradation. Technology of reducing pollution of agricultural products, environmental risks of land reclamation. Formation of skills of calculating costs of reclamation, environmental assessment of fertilizers interaction and ameliorants with the soil based on judging.</p>	5	v			v		v		v		
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>					v	v		v			

	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>	5				v	v		v		
	PD	EC	Agriculture Digitalization	<p>Goal: Studying of stages of transition to technologies of agriculture digitalization.</p> <p>Contents: Collecting information, conducting agrochemical survey of lands, developing planning and management systems, automating and robotizing production, introducing Smart technologies to ensure effective information exchange between network participants. Transition to point farming. Formation of skills to analyze how to improve the efficiency of business processes and increase crop yields when introducing digital technologies.</p>		v					v		v	
Industrial	BD	EC	Energy	<p>Goal: Formation of knowledge and</p>		v			v	v				

Chemical Module			Efficient Technologies of Mineral Acids	skills in the field of modern energy-saving technologies of mineral acids. 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.	6									
	BD	EC	Advanced Soda Ash Technologies	Goal: Formation of skills for choosing optimal technological mode of modern soda ash production. 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, performance of technological calculations of production.		v			v	v				
	PD	EC	Optimization	Goal: Studying of influence of soil	6						v	v	v	

		of Plant Mineral Nutrition	<p>composition and properties on plant nutrition mode, conditions for fertilization.</p> <p>Contents: Relationship between type of a mineral fertilizer and content of nutrients in it and effectiveness of fertilizer use on various types of soils. Formation of skills to analyze the content of nutrients in soil, application of analysis results in scientific research and formulating justified conclusions.</p>										
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	Resource Saving Technologies of	<p>Goal: Formation of ideas about modern methods of processing and disposal of technogenic waste and organization of waste-free technology.</p>	5	v			v	v				

		Technogenic Waste Processing	<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>										
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 emergencies.</p>	v				v					v
PD	EC	Advanced Technologies	<p>Goal: To study scientific foundations of fertilizer mixing and production of complex and complex-mixed mineral</p>				v	v				v	

		of Complex Mineral Fertilizers	<p>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>	6									
PD	EC	Modern Fertilizer Mixing Technologies	<p>Goal: To study new methods of obtaining complex-mixed fertilizers for agricultural crops of various purposes.</p> <p>Contents: Innovative technologies of fertilizer mixtures with introduction of microelements, balanced and unbalanced NPK-fertilizers on phosphoric acid technology, new compositions of mixed fertilizer for soils of various types. Determination of compatibility of fertilizer mixture components during storage and application of mixed fertilizers and to conduct tests.</p>				v	v				v	
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</p>	5				v	v			v	v

			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.											
	PD	EC	Chemical Technology of Reactive Acids and Salts	Goal: Study of scientific foundations and technological modes for production of reactive acids and salts. 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.		v			v	v				
Module of Research Work and Final Attestation			Research Work of a Master Student, Including Passing an Internship and	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	24	v	v				v	v	v	v

		Completing a Master's Thesis	scientific research. 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.										
		Execution and Defense of Master's Thesis	Goal: Evaluation of learning outcomes and key competencies achieved upon completion of the master's degree program. 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.	8	v	v				v	v	v	v

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

Year of study	Semester	Number of mastered modules	Number of studied disciplines		Number of KZ credits					Total hours	Total credits	The number of	
			UC	EC	Theoretical training	Pedagogical practice	Research practice	MSRW	Final examination			exam	diff. credit
1	1	2	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 AND METHODS OF TEACHING, MONITORING AND EVALUATION

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: 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 programs; • electronic textbooks; • digital resources. <p>Organisation 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>).</p> <p>Forms of assessment:</p> <ul style="list-style-type: none"> • questioning in class; • defence of independent works; • discussions; • trainings; • colloquia; • 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</p>

	<p>curriculum, academic calendar.</p> <p>The forms of conducting: exam in the form of testing; oral exam; written exam; combined examination; attestation on SRWM; defence of the practice and internship reports.</p> <p>The final state attestation is the defence of a dissertation.</p>
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7 EDUCATIONAL AND RESOURCE SUPPORT OF THE EDUCATION PROGRAM

Information and Resource Centre	<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/ppp.</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>
Material and technical base	<p>The material and technical base of the Chair of CTIS includes the following classrooms and laboratories for master's students:</p> <ul style="list-style-type: none"> • Laboratory of cooperation of LLP "Kazphosphate" and the chair of CTIS of M. Auezov SKU -126AB, • Laboratory named after Sh. Moldabekov - 316A; • Scientific laboratory for master's students - 320A; • Scientific laboratory of master's and doctoral students -331A • Lecture rooms with interactive whiteboard - 320A, 330A, 323A. <p>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>

