Ф.7.02-10

MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE REPUBLIC OF KAZAKHSTAN

M.Auezov SOUTH KAZAKHSTAN UNIVERSITY

«APPROVED»
Chairman of the Board-Rector
D.Zh. Ahmed-Zaki
«27» 03 2025

EDUCATIONAL PROGRAM

6B07160 – Chemical technology of inorganic substances

Registration number	6B07100038
Code and Classification of Education	6B07 - Engineering, Manufacturing and Civil Engineering
Code and Classification of Training Areas	6B071 - Engineering and Engineering Trades
Group of educational programs (EP)	B060 - Chemical Engineering and Processes
Type of EP	Active
ISCE level	6
NQF level	6
SQF of education level	6
Language of learning	English, Russian, Kazakh
The complexity of the EP	240 credits
Distinctive features of EP	
University Partner (JEP)	
University Partner (DDEP)	

Shymkent, 2025

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Developers:

Name	Position	Signature
Seitmagzimova G.M.	C.t.s., professor of TI&PCP department	
Altybayev Zh.M.	PhD, head of TI&PCP department	
Kadyrbaeva A.A.	C.t.s., associate professor of TI&PCP department	
Koshkarbayeva Sh.T.	C.t.s., associate professor of TI&PCP department	
Haritidi A.	Student of ChT-23-1r group	
Asilov A.A.	General director of LLP "KAZNIICHIMPROJECT"	Stamp
Zhantasov K.T.	Head of Research laboratory "Inorganic salts, growth stimulants and plant protection" at . M. Auezov SKU, Doctor of Technical Sciences, professor	

The Educational Program was considered at a meeting of Academic Quality Committee of the "Chemical Engineering & Biotechnology" Higher School,

Minutes # 7 from 13. 03. 2025.

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 # 4-1 from 18.03. 2025.

Chairman of the EMC _____ E.Imangaliyev

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

Minutes # 10 from 27. 03 2025.

Ф.7.02-10

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Chairman of the Board-Rector
_____ D.Zh.Ahmed-Zaki

«___»_____2025

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The Educational Program was considered at a meeting of Academic Quality Committee of the "Chemical Engineering & Biotechnology" Higher School,

Minutes # 7 from 13. 03. 2025.

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 # 4-1 from 04.03. 2025.

Chairman of the EMC _____ E.Imangaliyev

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

Minutes # _____ from _____ 2025.

CONTENTS

1 CONCEPT OF THE EDUCATIONAL PROGRAM

Mission of the University	Generating new competencies, training a leader who translates research thinking and culture.
University values	• 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	• 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.
The EP uniqueness	• Practice orientation and orientation to the regional labor market and social order through formation of graduate professional competencies, adjusted to stakeholder's requirements.
Academic Integrity and Ethics Policy	The university has taken measures to maintain academic integrity and academic freedom, protection from any type of intolerance and discrimination: • Rules of academic integrity (order No. 212 of October 10, 2022); • Anti-corruption standard (order No. 9 n/a dated 08.01.2025); • Code of Ethics (Order No. 212 of October 10, 2022).
Regulatory and legal framework for EP development	1. Law of the Republic of Kazakhstan "On Education"; 2. Model Rules for Activities of Organisations of Higher and Postgraduate Education», approved by order of the Ministry of Education and Science of the Republic of Kazakhstan dated October 30, 2018 No. 595 as reworded by order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated June 24, 2024. No. 307; 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 as reworded by order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated July 26, 2024. No. 372; 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; as reworded by order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated March 04, 2025. No. 90; 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; as reworded by order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated April 29, 2024. No. 203; 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 as reworded by order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated June 20, 2024. No. 207; 7. Methodological recommendations for introducing ECTS principles into the educational process and expanding academic freedom; Appendix 1 to the order of the Minister of Science and Higher Education. of the Republic of Kazakhstan dated February 12, 2024 No. 57; 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.
Organization of the education process	• Implementation of the Bologna Process principles • Student-centered learning • Availability • Inclusivity
EP quality assurance	• Internal quality assurance system • Involvement of stakeholders in the EP development and its evaluation • Systematic monitoring • Updating the content
Requirements for applicants	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, as reworded by order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated July 26, 2024, No. 372.
Conditions for the implementation of educational programs (EP) for persons with disabilities and special educational needs (SSN)	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. An individual differentiated approach is provided for all types of classes and in the organization of the educational process.

2 PASSPORT OF THE EDUCATIONAL PROGRAM

EP goal	Development of competitive bachelors possessing fundamental theoretical and practical knowledge, methods and instruments in the area of chemical engineering.
EP objectives:	• formation of socially responsible behavior in the society, understanding the importance of professional ethical standards and compliance with these norms; • providing with skills for lifelong learning that will allow graduates to successfully adapt to changing labor market conditions throughout all their professional careers; • providing conditions for acquiring a high general intellectual level of development, mastering the thinking culture and skills to organize processes of inorganic compounds manufacture; • formation of graduates'competitiveness in the field of chemical technology of inorganic substances to ensure employment opportunities in training direction or continuation of training on master degree programs; • creating conditions for formation of in-demand knowledge and skills, a conscious attitude towards improving the well-being of the population and protecting the planet in the context of SDGs.
EP harmonization	• Dublin descriptors of the 6th level of Qualifications; • the 6th level of the National Qualifications Framework of the Republic of Kazakhstan; • the 1stcycle of the Qualification Framework of the European Higher Education Area; • the 6th level of the European Qualification Framework for Lifelong Learning
EP connection with the professional sphere	• 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 "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 educational program, the graduate is awarded the degree "Bachelor of Engineering and Technology" on the EP 6B07160 - Chemical Technology of Inorganic Substances.
List of qualifications and positions	•chemical engineer • remote control operator in chemical production • process engineer for the production of chemical products • process engineer in research institutions, design and design organizations • equipment operator • dispatch engineer
Professional area	• chemical enterprises for the processing of mineral natural and technogenic raw materials • electrochemical and electrothermal productions • mining and processing plants • factory and scientific laboratories • research and design organizations
Objects of	- chemical technology of inorganic compounds;

professional activity	- mineral natural and technogenic raw materials; - processes and devices of chemical technology; - inorganic substances, mineral acids, salts and fertilizers; - design documentation; - analytical instruments and methods of analysis of chemical systems; - technological scheme of production.
Subjects of professional activity	- improvement of chemical-technological processes and devices; - industrial design; - ensuring the safety of chemical production; - enrichment of mineral raw materials; - processing of mineral and secondary raw materials, industrial waste; - operational control of the production process; - quality control of raw materials and products; - experimental study of chemical compounds; - industrial water treatment; - development of the technological scheme of production.
Types of professional activity	- production and technological activity; - organizational and managerial activity; - experimental research activity; - design activity.
Learning outcomes	**LO1** Possess information and computing skills, ability to generalize, analyze and apprehend the information; fluently communicate in professional environment and the society in Kazakh, Russian and English languages taking into account the principles of academic writing. **LO2** Use mathematical, social, historical and engineering knowledge and skills, methods of scientific research and elements of economic analysis in professional activities. **LO3** Demonstrate socio-cultural development based on knowledge of society development laws, formation of ideological, civil, spiritual and social responsibility, culture of academic honesty and decency. **LO4** Develop new and improve operating technological processes using artificial intelligence and based on the analysis of scientific and technological achievements and a critical assessment of the current state of chemical production. **LO5** Choose a rational technological scheme of production based on regularities of processing the mineral and technogenic raw materials, calculating mass and heat balances, main and auxiliary equipment. **LO6** Develop measures to improve production efficiency and safety and solve environmental problems by reducing waste and applying sustainable production methods in the context of the SDGs. **LO7** Plan and carry out theoretical and experimental research, interpreting the results obtained using methods of mathematical data processing and formulate conclusions. **LO8** Implement operative control of the production process for obtaining inorganic compounds, analysis of operative information on indicators for technological mode of plant units and control of quality of raw materials and products. **LO9** Use research, entrepreneurial skills and skills to work in conditions of uncertainty ensuring interconnection of enterprise structural divisions; continuously lifelong improve skills. **LO10** Work efficiently individually and in a team, persisting correctly in one-s opinion, make independent decisions in problem industrial situations showing analytical and critical thinking.

3 COMPETENCIES OF A GRADUATE OF THE EP

General competencies (SOFT SKILLS). Behavioral and personal skills	
GC 1. Competence in managing one's literacy	GC 1.1. The ability to self-educate, self-develop and constantly Up-to-Date knowledge in terms of chosen path with the interdisciplinarity conditions. GC 1.2. The ability to express ideas, feelings, facts, opinions in professional environment and critical thinking skills.
GC 2. Language competence	GC 2.1. The ability to create communication programs in national, Russian and international languages. GC 2.2. The ability for interpersonal, social and professional communication and mobility in intercultural communication.
GC 3. Mathematics and science competence	GC 3.1.The ability and willingness to apply the educational potential, experience and personal qualities acquired during the study of mathematical, natural science, technical disciplines at the university to solve professional problems.
GC 4. Digital competence and technological literacy	GC 4.1. The ability to demonstrate and develop information literacy through the mastery and use of modern information and communication technologies in all areas of lives and professional activities. GC 4.2. The ability to use various types of information and communication technologies: Internet resources, cloud and mobile services for the search, storage, protection, and dissemination of information.
GC 5. Personal, social and educational competence	GC 5.1. The ability for physical self-improvement and orientation for a healthy life to ensure full-fledged social and professional activities through methods and means of physical culture. GC 5.2. The ability for socio-cultural development based on the manifestation of citizenship and morality. GC 5.3 The ability to build a personal educational trajectory throughout life for self-development, career growth and professional success. GC 5.4 Ability to interact successfully in a wide range of socio-cultural contexts during study, work, home and leisure, using an inclusive approach to people with disabilities.
GC 6. Entrepreneurship competence	GC 6.1. The ability to be creative and enterprising in different environments. GC 6.2. The ability to work in the mode of uncertainty and rapid change of task conditions, make decisions, allocate resources, and manage the time. GC 6.3. The ability to work with consumer requests.
GC 7. Cultural awareness and self-expression	GC 7.1. The ability to show ideological, civic, and moral positions. GC 7.2. The ability to be tolerant to the traditions and other people culture in the world, and to possess high spiritual qualities.
Professional competencies (HARD SKILLS).	
PC 1. Natural Science competence	PC 1.1. Ability to apply educational potential, experience and personal qualities, acquired basic knowledge in the field of chemistry and chemical technology; to apply basic concepts, laws and theories to solve chemical-technological problems, to calculate and develop mathematical and natural science thinking.
PC 2. Research competence	PC 2.1. Successfully carry out research work, analyze the results and make conclusions, possess the skills necessary for professional activities and continuing education in the master program.

PC 3. Management competence	PC 3.1. Ability to manage technological processes and projects to achieve professional goals; coordinate the work of subdivisions, demonstrate entrepreneurial skills, evaluate production efficiency.

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

	LO1	**LO2**	**LO3**	**LO4**	**LO5**	**LO6**	**LO7**	**LO8**	**LO9**	**LO10**
GC1	+								+	+
GC2	+		+						+	+
GC3	+	+			+	+	+	+		
GC4	+	+					+			
GC5		+	+							+
GC6				+	+	+		+	+	+
GC7		+	+							+
PC1		+		+	+	+		+		
PC2				+			+		+	
PC3								+	+	+

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

№	Module title	Cycle	Component	Discipline title	Brief discipline description	Num. cr	Formed LO (codes)									
							LO 1	LO 2	LO 3	LO 4	LO 5	LO 6	LO 7	LO 8	LO 9	LO 10
1	Fundamentals of Public Sciences	GED	OC	History of Kazakhstan	**Goal:** Formation of an objective idea of the history of Kazakhstan based on a deep understanding and scientific analysis of the main stages, patterns and originality of the historical development of Kazakhstan. **Contents:** Ancient people and formation of nomadic civilization. Turkic civilization and the great steppe. Kazakh Khanate. Kazakhstan in the era of modern times. Kazakhstan as a part of Soviet administrative-command system. Declaration of Independence of Kazakhstan. State system, socio-political development, foreign policy and international relations of the Republic of Kazakhstan. Methods and techniques of historical description for analysis of causes and consequences of events in the history of Kazakhstan.	5		v	v							
2		GED	OC	Philosophy	**Goal:** Formation of a holistic idea about philosophy as a special form of knowledge of the world, about its main sections, problems and	5		v	v							

					methods of studying them in the context of future professional activity. **Contents:** Fundamentals of philosophical understanding of the world: questions of consciousness, spirit and language. Being. Cognition and creativity. Education, science, technology and technology. Human philosophy and philosophy of values. Ethics. The subject of aesthetics as a field of philosophical knowledge. Philosophy of freedom. Philosophy of art. Society and culture. Philosophy of history. Philosophy of religion. "Mangilik El" and "Modernization of Public Consciousness" are a new Kazakhstan philosophy.												
3	Socio-political Knowledge	GED	OC	Social and Political Studies	**Goal:** Formation of knowledge about social-and-political activities, explaining social-and-political processes and phenomena. **Contents:** Consideration of socio-ethical values of the society. Understanding features of social, political, cultural, psychological institutions in the context of their role in modernization of Kazakhstan's society. To solve conflict situations in society. Research of political institutions and processes, methods of analysis and interpretation ideas about politics, power, state and civil society. To understand and use the	4			**v**								**v**

					methods of sociological, comparative analysis, the meaning and content of the political situation in the modern world. Socialization, identity and deviant behavior: the role of an inclusive approach.											
4		GED	OC	Cultural Studies and Psychology	**Goal:** formation of scientific knowledge of history, modern trends, current problems and methods for development of culture and psychology, skills of systematic analysis of psychological phenomena. **Contents**: Morphology, language, semiotics, anatomy of culture. Culture of nomads, proto-Turks, Turks. Medieval culture of Central Asia. Kazakh culture at the turn of the XVIII - XIX centuries, XX century. Cultural policy of Kazakhstan. State Program "Cultural Heritage". National consciousness, motivation. Emotions, intellect. The will of man, the psychology of self-regulation. Individual typological features. Values, interests, norms are the spiritual basis. The meaning of life, professional self-determination, health. Communication of the individual and groups. Socio-psychological conflict. Models of behavior in conflict. Social and psychological foundations and development of inclusive culture in modern society.	4		**v**	**v**							

					Psychological features and conditions of professional adaptation of persons with disabilities; Psychological support and tolerance as a way of social integration of people with disabilities. Social and psychological barriers to interaction between persons with normal and impaired development in modern society.											
5	Socio-ethnic Development	GED	EC	Ecosystem and Law	**Goal:** Formation of integrated knowledge in the field of economics, law, ecology and life safety, research methods to achieve sustainable development of society. **Contents:** Fundamentals of safe interaction between man and nature, productivity of ecosystems and the biosphere. Improving the competitiveness of entrepreneurial activity of society, business and the national economy in conditions of limited resources within the framework of sustainable development goals of Kazakhstan. Systemic understanding of environmental issues and principles of sustainable development. Knowledge and observance of Kazakhstan's rights, duties and guarantees of subjects, state regulation public relations to ensure social progress. Inclusion is a strategy of international law. Legal bases of artificial intelligence.	5		**v**	**v**			**v**				

					Inclusion as strategy of international legislation.												
6		GED	EC	Entrepreneurship and Financial Literacy	**Goal:** Training skills in entrepreneurial activity organization, in managing personal and family financial resources, which are key to achieving financial well-being. **Contents:** Entrepreneurship: essence, contents and conditions of formation. Legal forms of entrepreneurship. Risks in entrepreneurship. Business planning in entrepreneurship. Organization of entrepreneurial transactions. Culture and ethics of entrepreneurship. Financing of entrepreneurial activity. The concept, goals and objectives of financial literacy. Money, settlements, and payments. Personal finance: income, expenses, budget. Taxes and taxation of individuals. Pensions and insurance. Banking services for the population. Bankruptcy of individuals and financial risks. Pyramid scheme and personal financial security.			**V**							**V**	
7		BD	EC	Muchtar studies	**Goal:** Studying the life and creativity of M. Auezov. **Contents:** Life and creative activity, main dates of life and activity of Mukhtar Auezov. Formation of Mukhtar studies science; scientific works on the work of Auezov, the role and	3			**v**							

					significance of Auezov's works in Kazakh and world literature, scientific, social and journalistic activities of the writer. His first editions, the pinnacle of Auezov's work is the historical novel "The Way of Abai"; images of Abay and Kunanbay. Modern scientific research of Mukhtar studies. Scientific works about the science of Mukhtar studies.												
8		BD	EC	Abay Studies	**Goal:** Preservation of «national code» in «Kazakhtanu» project based on creativity of A.Kunanbayev. **Contents:** Studies of Abai's legacy of XX-XXI centuries. Chronology of Abai's creativity. Abai is a great poet, ethnographer, founder of Kazakh written literature. Abai is the compiler of the code of laws «The Position of Karamola», social significance. Abai is a thinker, religious scholar, philosopher. The role of Abai in education and science, the concept of «Holistic person». «Words of Edification» by Abai, an epic novel by M.Auyezov «The Way of Abai» . K. Tokayev «Abai and Kazakhstan in the XXI century», role, significance.				v								
9		BD	EC	Fundamentals of Anticorruption Culture	**Goal:** Formation of anti-corruption worldview, strong moral bases of a personality, civil position, stable skills of anti-corruption behavior. **Contents:** Overcoming legal				v							

					nihilism, formation of bases of students' legal culture in the field of anti-corruption legislation. Formation of conscious attitude towards corruption. Moral rejection of corrupt behavior, corrupt morality and ethics. Development of skills necessary for anti-corruption. Development of anti-corruption standard of conduct. Anticorruption propaganda, dissemination of lawfulness and respect for the law. Activities aimed at understanding the nature of corruption, awareness of social damage caused by its manifestation, ability to defend one's position with arguments, seeking ways to overcome manifestation of corruption. Application of AI in combating corruption.											
10		BD	EC	Fundamentals of artificial intelligence	**Goal:** To develop competencies in the use of knowledge and practical application of artificial intelligence tools and methods, in alignment with the priorities of the AI-Sana program. **Contents:** Introduction to Artificial Intelligence (AI). Development of practical skills and abilities, including: using AI tools; working with large language models (LLMs); utilizing no-code AI platforms; employing generative AI tools; image recognition; natural language processing (NLP); and					**v**						

					data visualization through AI. Understanding the application of AI in various fields and exploring its potential through the integration of AI-Sana program approaches.											
11	Module of Communication and Physical Education	GED	OC	Kazakh (Russian) language	**Goal:** Formation of communicative competence using Kazakh (Russian) language in socio-cultural, professional and public life, improvement of ability to write academic texts. **Contents:** Levels A1, A2, B1, B2-1, B2-2 (B2, C1 Russian language) are presented in the form of cognitive-linguocultural complexes, consisting of spheres, themes, sub-themes and typical situations of communication of the international standard: social, social - cultural, educational and professional, modeled by forms of oral and written communication, written speech works, listening. Demonstration of understanding the language material in texts on the educational program, knowledge of terminology and development of critical thinking.	10	**v**		**v**								
12		GED	OC	Foreign Language	**Goal:** Formation of intercultural and communicative competence in the process of foreign language education at sufficient level A2 and level of basic sufficiency B1. **Contents:** Levels A1, A2, B1, B2 are presented in the form of cognitive-linguocultural complexes,	10	**v**		**v**							**v**

					consisting of spheres, themes, sub-themes and typical communication situations of international standard: social, social - cultural, educational and professional, modeled by forms: oral and written communication, written speech works, listening. Demonstration of language material's understanding in texts on the educational program, knowledge of terminology and critical thinking development.											
13		BD	HSC	Professionally Oriented Foreign Language	**Goal:** To give students practical skills in the use of foreign language for optimal communication in the process of scientific research and development of socio-cultural competencies. **Contents:** Development of English terminology in the field of chemical engineering. Features of the translation of scientific and technical literature. Editing after automatic translation. Evaluation of semantic accuracy Estimation of semantic accuracy and adequacy of written scientific and technical translation. Mastering the practical skills of spoken English. Formation of skills to search for scientific information on the specialty in a foreign language.	3	**v**						**v**			
14		GED	OC	Information and Communication Technologies	**Goal:** Formation of abilities to critically evaluate and analyze methods of searching, storing and processing information, methods of	5	**v**	**v**					**v**			

					collecting and transmitting information through digital technologies. Development of new "digital" thinking, acquisition of knowledge and skills in the use of modern information and communication technologies in various activities. **Contents:** Introduction and architecture of computer systems. Software. Operating systems. Human-computer interaction. Database systems. Data analysis. Data management. Networks and Telecommunications. Cybersecurity. Internet technologies. Cloud and Mobile technologies. Multimedia technologies. Smart technology. E-technologies. Electronic business. Electronic government.											
15	Fundamentals of Engineering and Technical Sciences	BD	HSC	Higher Mathematics	**Goal:** Formation of knowledge in algebra, analytical geometry and mathematical analysis, necessary for studying engineering disciplines and solving mathematical problems. **Contents:** Linear and vector algebra, analytic geometry; introduction to mathematical analysis; differential calculus of a single variable function. Derivative and its geometric and physical meaning. Indefinite and definite integrals. Row theory. Formation of skills to select algorithms and solve typical mathematical problems,	6	**v**	**v**			**v**					

					apply them in professional activities.											
16		BD	HSC	Physics	**Goal:** Formation of physical laws knowledge and skills of their application in chemical engineering, development of scientific thinking based on interdisciplinary approach. **Contents:** Laws of classical and modern physics (mechanics, molecular physics, thermodynamics, electromagnetism, optics, quantum and atomic physics). Application of knowledge of physical phenomena and processes for solving applied and technical problems. Scientific research methods, methods for processing and analyzing the results of theoretical and experimental research.	5		v			v		v			
17		BD	EC	Applied mechanics	**Goal:** Study of basic laws of mechanical motion, modern methods for calculating the strength of typical elements of machines and constructions to use knowledge gained in practical activities in solving professional problems. **Contents:** Conditions for equilibrium of bodies, kinematics of the movement equation, fundamentals of dynamics, resistance of materials, strength, rigidity, fatigue and stability. Formation of skills to implement standard tests to determine	4		v								

					physicomechanical properties of materials in the design and determination of critical loads for calculation of production equipment.											
18		BD	EC	Corrosion and Metal Protection	**Goal**: Study of corrosion processes and methods of metal protection from corrosion. **Contents**: Study of chemical corrosion kinetics. Chemical mechanism of corrosion and oxidation of metals. Thermodynamics of electrochemical corrosion. Corrosion diagrams, passivity of metals. Atmospheric corrosion. Underground and marine corrosion of metals. Analysis of indicators of electrochemical corrosion of metals, types of destruction, methods of combating corrosion of metals. Metallic and non-metallic protective coatings, corrosion inhibitors and anti-corrosion lubricants. Ecological problems of corrosion of metals.					v		v				
19		BD	HSC	Fundamentals of Electrical Engineering and Electronics	**Goal:** Formation of a holistic view and knowledge system in the field of theory of electromagnetic processes, production and transmission of electrical energy, as well as formation of a set of competencies in the field of electrical engineering and electronics to such an extent that they can choose necessary	4							v	v		

					electrical, electronic, electrical measuring devices, be able to explain their work and operate them correctly. **Contents:** Basics of electrical safety. Basic concepts and definitions. Linear electric circuits of direct and alternating current. Three-phase circuits. Obtaining a symmetrical three-phase e.d.f system of nonlinear and magnetic circuits. The concept of transients in electrical circuits, the causes of their occurrence. Electrical measurements and measuring devices. Transformers and electrical machines. The element base of modern electronic devices, pulse and digital devices.											
20	Module of Engineering	BD	HSC	Engineering Computer Graphics	**Goal**: Formation of skills to use computer graphics elements, methods of projection and imaging. **Contents**: Training practical implementation of general technical and specialized drawings in accordance with SS. Construction of standard axonometric projections. Work with modern computer programs in the AutoCAD computer-aided design environment. Skills in building and reading technical drawings, knowledge of computer graphics system and ability to create design documentation in the AutoCAD graphics system. Interaction of	4	**v**	**v**								

					AutoCAD with other graphic programs.											
21		BD	EC	Engineering Economics	**Goal**: Development of economic thinking and practical skills in performing engineering and economic calculations based on the study of the economic mechanism of the enterprise functioning in market conditions. **Contents:** Engineering economics, the purpose and objectives of the course. The main features, tasks and functions of the enterprise. The fixed and working capital of the enterprise. The staff of the enterprise. Labor payment at the enterprise. Investment and innovation activity of the enterprise. Planning of the production activity of the enterprise. Marketing activity of the enterprise. Production costs and prime cost. Profit and profitability. Economic efficiency of the enterprise's activity.	4		**v**							**v**	
22		BD	EC	Organization of production and management	**Goal**: To study the most important elements of effective organization of production and industrial infrastructure of modern enterprises. **Contents**: Modern production as a complex organizational system. Distinctive features of production organization and management in market conditions. The role of production organization in chemical industry intensification. Basic			**v**								**v**

					economic categories and regularities of economic development. Teaching to independently make justified decisions, taking into account the calculations performed, to clearly formulate conclusions and proposals based on the results obtained.											
23		BD	HSC	Standardization, Certification and Metrology	**Goal:** Formation of knowledge of theoretical foundations of metrology, standardization and certification. **Contents:** Normative documents on standardization in Kazakhstan. Standardization in the field of chemical engineering, quality standards for raw materials and products. Trends in the development of certification in Kazakhstan and abroad. Metrology is the science of measurements. The concept of measuring inaccuracy. Methods and means of measurement. Certification of products, calibration and verification of measuring instruments. Metrological control of the analysis of raw materials and products in testing laboratories.	4								**v**		
24	Module of Chemical Engineering	BD	HSC	General Chemistry	**Goal:** Studying basic laws of chemistry, properties of chemical elements and inorganic compounds. **Contents:** Laws of chemistry, dependence of substance properties	4				**v**	**v**					

					on their composition and structure, general regularities of chemical reactions. Theory of atom structure and chemical bond. Main classes of chemical compounds, types of chemical reactions. Using the acquired knowledge to analyze the processes occurring in technological objects. Skills in applying the Mendeleev periodic law to describe the periodicity of changes in atoms' properties.											
25		BD	EC	Physical and Colloid Chemistry	**Goal:** Studying the regularities of phase equilibria in solutions and melts and colloid disperse systems. **Contents:** Phase equilibrium in solutions. Basic laws of electrochemical processes. Chemical kinetics and catalysis. Colloid disperse systems. Thermodynamics and structure of the surface layer. Factors affecting surface tension. Intermolecular and interfacial interactions; cohesion; adhesion, wetting. Formation of skills to build a phase diagram, to apply Hess's law, the laws of thermodynamics for analysis of technological processes.	4		v					v			
26		BD	EC	Analytical Chemistry	**Goal:** Mastering the methods of analysis methods and their application to solve practical problems. **Contents:** Methods for studying and controlling the chemical composition of substances in								v	v		

					production conditions and scientific research. Metrological foundations of quantitative analysis in analytical chemistry. Choice of a method for analyzing a product composition in technology of inorganic substances: gravimetry; titrimetry. Study of qualitative reactions of cations and anions. Method of analytical determination of product composition in technological processes.											
27		BD	EC	Industrial Chemistry	**Goal:** Studying the properties and methods for obtaining inorganic products produced on industrial scale. **Contents:** Chemical and physical properties of inorganic substances and compounds. The role of oxygen and hydrogen in chemical technology. Water. Features of chemistry of carbon, silicon and their compounds. Obtaining nitrogen and ammonia; phosphorus and its compounds. Sulfur, its compounds and properties. Compounds of halogens with metals and non-metals. Use of acquired knowledge in analysis of chemical-technological processes.	5		V					V			
28		BD	EC	Basics of Electrochemical Technology	**Goal**: Studying the theoretical fundamentals of electrochemistry, acquiring knowledge on ion-dipole and ion-ion interactions in electrolyte solutions. **Contents**: Electrochemical								V			

					thermodynamics and kinetics, non-equilibrium phenomena in electrolyte solutions, electrochemical potential and equilibrium in an electrochemical circuit. Experimental study of electrochemical processes; polarization phenomenon, corrosion processes of metals and alloys. Application of the Nernst equation to calculate potentials and EMF, Faraday's laws to determine indicators of electrolysis. Application of the Debye-Hückel theory to weak electrolytes.											
29		BD	EC	Fundamentals of Chemical Technology	**Goal:** Formation of knowledge of scientific fundamentals of chemical-technological processes. **Contents:** Structure of chemical production. Periodic and continuous processes. Criteria for effectiveness of chemical production. Methods of chemical technology, analysis and synthesis of chemical-technological systems. Regularities of homogeneous, heterogeneous and heterogeneous catalytic chemical processes. Chemical reactors. Mathematical models of perfect and real mixing and displacement reactors. Study of typical chemical production in laboratory practicum carrying out. Instilling skills in calculating mass and heat balances of processes.	6		**v**		**v**	**v**					
30		BD	EC	Regularities of	**Goal:** Formation of knowledge of					**v**	**v**	**v**				

				Technological Processes	physical-chemical Regularities of chemical-technological processes. **Contents:** General characteristics of chemical-technological processes, thermodynamic analysis. Limitations in Le-Chatelier principle on pressure, temperature and reagent excess. Calculation of reaction mixture equilibrium composition. Kinetics of homogeneous and heterogeneous processes, regions of behavior, methods of their intensification. Analysis of factors limiting chemical processes. Characteristics of heterogeneous catalytic processes. Mechanism of catalyst action. Selection and calculation of efficient reactors. Mastering skills to substantiate optimal technological mode of production.											
31		BD	EC	Processes and Apparatuses of Chemical Technology	**Goal:** Studying the theoretical fundamentals of chemical technology processes. **Contents:** Fundamentals of applied hydraulics. Hydromechanical processes and apparatuses: settling, filtration, centrifuging gas purification. Mechanical processes and equipment: grinding, crushing. Heat processes. Fundamentals of heat transfer. Classification of heat exchange equipment and its calculation. Evaporation, calculation of an evaporator. Mass transfer fundamentals. Molecular	5		v		v	v					

					and convective mass transfer. Mass transfer processes: absorption; simple distillation and rectification; liquid extraction; adsorption; drying; crystallization. Calculation of mass transfer apparatuses.											
32		BD	EC	Heat and Mass Transfer Processes	**Goal**: To study main heat and mass transfer processes in chemical technology. **Contents:** Heat processes: heating, cooling, condensation. Fundamentals of heat transfer. Calculation of heat exchange equipment. Evaporation, calculation of an evaporator. Industrial methods of heat transfer in chemical equipment. Mass transfer processes: absorption; simple distillation and refining; liquid extraction; adsorption; drying; crystallization. Molecular and convective mass transfer, basic mass transfer equation. Analysis, calculation and design of main heat and mass transfer processes and apparatuses for chemical productions.			v		v	v					
33		BD	EC	Industrial Organic Chemistry	**Goal:** Studying the composition, structure, properties and methods of obtaining organic compounds. **Contents:** Types of chemical bonds and mutual influence of atoms in molecules of organic compounds. Hydrocarbons (alkanes, alkenes, alkynes, cycloalkanes, dienes, arenes) and their derivatives.	4					v	v				

					Production methods, chemical properties and use of hydrocarbons and derivatives; oil, its composition and processing methods; polymers, halocarbons. Instilling skills to solve problems of cleaning organic compounds, recycling organic waste with solving environmental problems.											
34		BD	EC	Biochemistry	**Goal:** Studying the general provisions and theoretical foundations of biochemistry course. **Contents:** Biochemistry, objects of its research. Biochemical research. The concept of assimilation and dissimilation. Biochemistry of microorganisms. Anaerobic carbohydrate metabolism and plant respiration, fermentation processes, oxidative and metabolic processes. Amino acids, vitamins, hormones, minerals, their physiological role and mechanism of action. Formation of skills to analyze biochemical processes occurring in biological objects, independently conduct experiments to study biochemical processes.								**v**			
35	Module of Introduction to the Specialty	BD	EC	Introduction to Specialty	**Goal:** Familiarization of students with future profession, basic requirements for bachelor training. **Contents:** Characteristics of the educational program "Chemical technology of inorganic substances", interdisciplinary connection, qualification	4		**v**		**v**						

					characteristics of Bachelor of engineering and technology, main stages of chemical technology development. History of development of inorganic substances' main productions. Understanding the nature of future work of a bachelor of engineering and technology, motivation for professional activities.											
36		BD	EC	Basics of Academic Writing	**Goal:** Teaching a structured presentation of own ideas, creating scientific texts. **Contents:** Specifics and types of academic writing, principles of creating a scientific text, rules for constructing scientific texts of various genres. Norms of literary Kazakh and Russian, development of oral and written speech through the use of phraseological turns, proverbs and sayings. Skills of presenting own ideas, compiling scientific texts. Teaching effective methods of interpersonal and professional communications in Kazakh and Russian.		**v**		**v**							
37		BD	EC	Theoretical Fundamentals of Technology of Inorganic Substances	**Goal:** Formation of knowledge of theoretical fundamentals of chemical-technological processes and skills of their application to assess the effectiveness of processes. **Contents:** Physico-chemical and thermodynamic characteristics of systems, approximate methods for	5				**v**	**v**		**v**			

					calculating heat capacities, calculation of thermodynamic potentials, thermodynamics of gas-liquid conversions. Formation of skills to use thermodynamic characteristics of system state to determine probability and direction of the process proceeding, to make decisions on optimization and improving chemical-technological processes in the technology of inorganic substances.											
38		BD	EC	Theory and Technology of Mineral-Salt Processes	**Goal: S**tudy of mineral-salt methods for separation of water-soluble systems and calculation of phase equilibria. **Contents:** Solubility diagrams of binary and ternary water-salt systems, calculation of evaporation, dissolution and crystallization processes using solubility diagrams. Technologies of table salt, boric acid, mineral fertilizers production by mineral-salt method, methods of separation of natural salts. Formation of skills for calculating salt crystallization processes using phase diagrams, to use them in scientific research, to choose rational ways for processing mineral raw materials.						v		v			
39	Module of Fundamentals of Specialty	PD	EC	Technology of Mining and Preparation of Mineral and Secondary	**Goal**: Study of methods of mining and preparation of mineral raw materials for processing. **Contents:** Mineral mining methods. Well drilling and blasting.	5				v	v					

				Raw Materials	Development, overburden works. Soluble salts in nature and methods for their mining. Value of mineral enrichment. Screening, crushing and grinding. Gravitational processes of enrichment. Flotation. Methods of electromagnetic, electrostatic and chemical enrichment. Preparation for processing of secondary raw materials. Analysis of the efficiency of enrichment of raw materials for improvement of technological processes.											
40		PD	EC	Chemical Kinetics and Catalysis	**Goal:** Study of kinetics of homogeneous chemical reactions and scientific fundamentals of heterogeneous catalysis. **Contents:** Kinetic analysis of simple irreversible and reversible and complex reactions, method of determining the order and reaction rate constants, interconnection of kinetics and thermodynamics, principles of activation in catalysis, kinetics of catalytic reactions, poisoning, promotion, modification of a catalyst. Formation of skills of calculating kinetic characteristics using mathematical methods, to determine technological characteristics of solid catalysts.			v			v		v			
41		BD	EC	Technique of Experimental Studies	**Goal:** Formation of skills in organizing experimental research. **Contents:** Planning of experimental work, stages of	4		v					v	v	v	

					implementation. Integrated use of research methods. Criteria for evaluating the results of measurements, error of experiment, reliability and reproducibility of research results. Instrumental methods of analysis. Sampling and preparation of material samples for analysis. General procedure for performing chemical analysis. Processing of experimental results and their interpretation. Teaching to formulate conclusions based on experimental results.											
42		BD	EC	Quality control of Inorganic Substances	**Goal:** Mastering methods of quality control of inorganic products. **Contents:** Quality control system for inorganic products. Standardization based on SS and TC. Accreditation and certification of the chemical control laboratory. Activities of testing laboratories. Methods of sampling, research of chemical composition and structure of target products and production waste. Procedure for assessing the compliance of chemical products with standard requirements. Chemical, spectral, chromatographic and thermal methods of analysis. Analysis and processing of experimental data.			v					v	v		
43		PD		Industrial Practice I	**Goal:** Consolidation of theoretical knowledge on main regularities of technological processes, studied in general engineering disciplines.	4				v	v	v				

					Contents: Practical consolidation of knowledge of main regularities of technology at chemical enterprises, main methods of processing mineral raw materials and production waste. Application in practice of knowledge of operation of main and auxiliary technological equipment, requirements for environmental safety of production, solving problematic industrial issues.											
44	Module of Fundamentals of Applied Sciences	PD	EC	Energy - Technological Systems in the Technology of Inorganic Substances	**Goal:** Study of main ways to save energy in production of inorganic compounds. **Contents:** Energy-technological systems, types of exergy. Thermodynamic analysis of energy-technological systems; ways to reduce fuel and energy consumption in the technology of inorganic substances. Reuse of energy. The use of physical heat of combustion products. Methods to improve the energy and environmental efficiency of productions of inorganic substances. Acquisition of skills in analyzing the operation of heat power plants, calculating mass and heat flows in heat-using apparatuses. Application of AI in thermodynamic analysis of CTS.	4					v	v				
45		PD	EC	Electroplating Technology	**Goal:** Acquisition of knowledge on obtaining coatings of various metals by electroplating.						v		v			

					Contents: Structure of electroplating coatings. Preparation of metal product surface. Electrolytic method for obtaining various types of coatings. Electrolytic coatings with precious metals. Electrolyte compositions for chromium plating, silver plating and gilding, for electrolytic tinning, lead plating and iron plating. Electrode processes, features of chromium plating technology. Technique of applying electroplated coatings by nickel plating, copper plating and cadmium plating, composite coatings by galvanic-chemical method. Evaluation of electrochemical process efficiency.											
46		PD	EC	Electrotechnology in Inorganic Substances Production	**Goal:** To study schemes of electrotechnological production. **Contents:** Electrothermal manufactures of inorganic substances, their safety, principles of heat calculation of electrical resistance furnaces; construction, principle of operation and calculation of electric ore-smelting furnaces, calculation of charge composition. Electrical equipment, measuring equipment. Analysis of processes proceeding during phosphorus electrothermal sublimation, production waste, agglomeration of small fractions, sintering process. Production of	5				v	v					

					calcium carbide, ferrosilicon and electrocorundum. Reducing agents in the production of ferroalloys. Electrothermy of crystalline silicon.											
47		PD	EC	Phosphorus Technology	**Goal:** Study of physicochemical bases and technology of yellow phosphorus. **Contents:** Chemical and physical properties of phosphorus, physicochemical bases and raw materials for yellow phosphorus production, Composition of phosphate-siliceous melts. Analysis of main and side reactions, characteristic of stages of phosphorus production and equipment used. Technological scheme of production, methods of disposal of production wastes. Formation of skills of calculating mass and heat flows of phosphorus production, technological indicators of electric furnace operation.						v	v		v		
48		PD		Industrial Practice II	**Goal:** Consolidation of theoretical knowledge and practical skills on the studied special disciplines; collection of material for implementation of course projects and works. **Contents:** Acquaintance with the technology of production at chemical enterprises, study of the technological scheme and technological regulations for production of inorganic acids, salts	6					v			v	v	

					and mineral fertilizers. Analysis of the operation of main and auxiliary technological equipment. Mastering the skills of managing the shop, maintaining norms of the technological regime; compliance with safety regulations.											
49		PD	EC	Management Systems of Chemical andTechnological Processes	**Goal**: Study of control systems for chemical-technological processes. **Contents**: Computer and microprocessor systems for monitoring and control technological processes and complexes, elements of measuring and automatic devices, automatic systems of control, regulation and management, principles of operation of sensors and secondary devices and controllers, building a functional scheme for controlling technological process parameters, actuators and regulatory bodies. Application of knowledge of measuring devices and a principle of sensor operation for regulation of technological parameters.	4		v						v		
50		PD	EC	Basics of Modeling Chemical Technology Objects	**Goal:** Study of concepts, stages and methods of mathematical modeling of chemical-technological processes. **Contents:** Mathematical modeling, numerical experiment method. Scheme for constructing mathematical models of chemical technology processes. Methods for checking the adequacy of model		v						v			

					and object and its correction. Mathematical models of chemical reactors. Statistical mathematical models. Processing the results of active experiments. Use of computer technologies for identification of mathematical description and optimization of processes.											
51		PD	EC	Industrial Water Treatment	**Goal**: Training in methods of preparing recycled water for reuse and sewage treatment. **Contents:** Main stages of industrial water treatment, sewage from chemical enterprises. Instilling the skills of preliminary purification of water by methods of coagulation, liming, settling and filtration, water desalination. Methods for preventing scale formation in evaporation and boiler installations, methods for cooling circulation water of heat exchange equipment. Formation of skills of sewage treatment, choice of rational water treatment system.	5					v	v		v		
52		PD	EC	Physico-chemical Methods of Water Purification	**Goal**: To study physicochemical regularities of purification of waste and natural water from impurities. **Contents:** Characteristics of natural and technological water quality indicators, requirements for water quality at chemical enterprises, methods of sewage treatment. Physicochemical bases of ion-exchange method of water						v			v		

					desalination, membrane and thermal methods of water purification. Formation of skills of choosing rational water treatment system taking into account the requirements, calculating and analyzing the stages of water preparation.											
53		PD	EC	Fundamentals of Design and Equipment of Plants	**Goal:** to study stages of designing industrial facilities, calculation and design of chemical equipment. **Contents:** Principles of designing industrial facilities, basic regulatory documents governing design work. Design stages; application of programs for optimal design of chemical-technological productions, hardware design of technology. Materials for chemical apparatuses, corrosion protection. Placement of equipment, layout of industrial premises, technological schemes, design of engineering networks. Acquisition of skills to independently perform the mechanical calculation of main and auxiliary equipment. Making AI-Based Design Layout Decisions.	6				v	v	v				
54		PD	EC	Layout Solutions for Designing Equipment and Enterprises	**Goal**: Study of principles of layout solutions for designing equipment and enterprises of chemical industry. **Contents:** Design of shops for the production of phosphorus, mineral fertilizers, acids, technical, feed and food salts. The role of the					v	v	v				

					technological scheme and the scheme of material and energy flows in selection of optimal options for placement of buildings and constructions on the master plan. The layout of premises, principles of placement of technological equipment. Space-planning decisions of the shop. Piping of technological equipment. Acquisition of skills to independently perform technological calculations of equipment.											
55		PD	EC	Environmental Problems in the Technology of Inorganic Substances	**Goal:** Study of methods of purification and utilization of solid, liquid and gaseous industrial waste from inorganic substances productions. **Contents:** Sources of formation of solid and liquid waste. Regulatory documents in the field of environmental protection. Ways to reduce harmful emissions. Methods for cleaning, recovery and disposal of solid industrial waste, sewage and gaseous emissions from chemical enterprises, equipment used. Skills to evaluate the effectiveness of various purification methods.	5					v	v				
56		PD	EC	Environmentally Safe Technologies	**Purpose:** To study problematic issues of industrial chemical enterprises in the light of modern environmental requirements. **Contents:** Relevance and						v	v				

					importance of environmentally friendly (low-waste and waste-free) technologies. Principles of organization of waste-free production: consistency, complex use of raw material components, cyclical nature of material flows, rational organization, environmental safety. Nature and properties of air pollutants. Rationing of atmospheric impurities. Environmental assessment of various schemes for production of inorganic substances to select the best option.											
57	Module of Technology of Inorganic Compounds	BD	EC	Technology of Inorganic Gases and Acids	**Goal:** Study of theoretical fundamentals, analysis of production of inorganic gases and acids. **Contents:** Steam-oxygen conversion of natural gas. Technology for production of ammonia and nitric acid, schemes for sulfuric acid production from various raw materials. Production of hydrochloric, hydrofluoric and boric acids. Physico-chemical bases for production of yellow phosphorus, dry and wet-process phosphoric acid. Formation of skills to obtain and investigate acids, calculate process technological flows, critically analyze and select rational schemes for mineral acids production.	6	v				v	v				v
58		BD	EC	Technology of	**Goal:** Study of physicochemical						v	v				

				Soda and Soda Ash Products	bases and technology for obtaining soda ash and caustic soda. **Contents:** Production of soda ash and caustic soda, purified sodium bicarbonate. Functional scheme and technological mode of soda ash production by Solvay method. Comparative analysis of lime, ferrite and electrochemical diaphragm and mercury methods for producing caustic soda. Acquisition of skills to substantiate the need for a cyclic scheme for soda ash production, determine optimal conditions for main stages.											
59		BD	EC	Technology of Mineral Salts and Alkalis	**Goal:** Study of physico-chemical bases and technological modes for production of mineral salts and alkalis. **Contents:** Characteristics of sodium- and potassium-containing natural salt deposits in Kazakhstan. Physico-chemical bases, rational technological schemes for production of mineral salts and alkalis, ortho- and metaphosphates, condensed phosphates, sulfates, chlorides, carbonates and nitrates of sodium, magnesium and potassium. Skills in calculating technological processes for obtaining mineral salts and alkalis, assessing the quality of a target product.	5					v	v		v		
60		BD	EC	Non-Waste Technology	**Purpose:** Obtaining knowledge necessary for analysis and development of modern non-waste						v	v				v

					and low-waste chemical technologies. **Contents:** Technologies of complex processing the chemical waste, the use of solid industrial waste from chemical productions containing nutrients as additives in mineral fertilizer production. Complex resource-saving technology for processing waste from production of phosphorus, wet-process phosphoric acid. Formation of skills to analyze industrial chemical waste, to solve problematic issues of processing technogenic waste.											
61		PD	EC	Technology of Mineral Fertilizers	**Goal:** Study of technologies of phosphoric, nitric and potash mineral fertilizers. **Contents:** Classification of mineral fertilizers according to nutrients' content. Physico-chemical bases, properties and technologies for obtaining phosphoric (superphosphates, ground phosphorite), nitric (ammonium nitrate, carbamide, ammonium sulfate), potash (potassium chloride, potassium sulfate) and complex fertilizers. Choice of optimal technological modes, calculation of apparatuses. Acquisition of skills to solve problematic issues, evaluate quality of mineral fertilizers.	7					v	v		v		v
62		PD	EC	Food and Feed	**Goal:** Study of composition and					v	v			v		

				Phosphate Technology	methods of obtaining food and feed phosphates in accordance with standard requirements. **Contents:** Technology for obtaining food and feed mineral products. Production of feed precipitate, monocalcium phosphate, diammonium phosphate, food and feed sodium tripolyphosphate and pyrophosphate, disodium phosphate, diammonium phosphate and tricalcium phosphate. Technological schemes of productions. Formation of skills to determine composition of feed and food phosphates taking into account standard requirements, to suggest new methods to obtain them.											
63		PD	EC	Uranium Chemistry and Technology	**Goal:** Study of physical and chemical bases of leaching of uranium ores and extraction of uranium from solutions. **Contents**: Uranium ore deposits in Kazakhstan. Underground leaching of uranium ores. Downhole systems for underground leaching of uranium from ores. Sorption and extraction methods for processing uranium solutions. Physicochemical bases of uranium sorption process. Precipitation of concentrates from uranium-containing solutions. Refining of uranium concentrate. Hardware design of stages of processing uranium ores,	5					v	v		v		

					environmental safety of production. Calculation of technological indicators of processes.											
64		PD	EC	Nuclear Chemical Technology	**Goal:** Study of theoretical bases of nuclear chemical technology. **Contents:** Nuclear energy, chain reactions. Radioactive isotopes. Extraction of radioactive elements from ores. Determination of the type of radiation, half-life. Ways to utilize the energy of nuclear reactors. Nuclear power plants, disposal of waste from the uranium industry. Environmental protection and radiation safety. Chemical consequences of nuclear transformations. Technological methods for separation of rare earth elements. Nuclear fuel cycle. Formation of skills to analyze scientific and technical problems and prospects for development of nuclear chemical technology.					**V**		**V**		**V**		
65	Research module	PD	EC	Study Research Work of Students	**Goal:** Training in organization, planning and implementation of educational-research work. **Contents:** Stages of students' research work, methods for analyzing composition of raw materials and products, mathematical methods for processing the results of experimental-research work, formulating conclusions and formalizing research results. Acquisition of skills to correctly	5							V		V	V

					formulate the formulation of research problems, conduct experiments and chemical analysis of products, critically analyze research results, clearly formulate conclusions based on the results obtained.											
66		PD	EC	Laboratory Practicum on Specialty	**Goal:** Formation of skills for independent implementation of experimental research work. **Contents**: Performing experimental work on the topic of students research work in accordance with the task and stages of the study, based on theoretical analysis of the latest achievements of science and technology in the field under study. Teaching the abilities to formulate scientific novelty and practical significance of the developed technological process and present the work results in the form of a thesis or a scientific article.					**v**			**v**		**v**	
67		BD	EC	Fundamentals of Technology of New Materials	**Goal:** Study of general regularities and methods for obtaining new metallized non-metallic materials. **Contents:** Structure and properties of metallic, nanostructured composite materials. Metallization methods for plastics and other dielectric materials. Main types of chemical coatings and obtaining methods. Composite chemical and electrochemical coatings. Analysis of efficiency of processes for production of materials for various	5				**v**	**v**		**v**			

					purposes, improving characteristics of materials as a result of processing. Analysis of the structure of materials by X-ray phase, spectroscopic, electron microscopic methods.											
68		BD	EC	Fundamentals of Scientific Research	**Goal:** Mastering modern methods of collecting, storing and processing information. **Contents:** Methods of theoretical and experimental research. Methodology for choosing the direction of scientific research and assessing the topic relevance. Techniques of working with scientific literature, search, accumulation and processing of scientific information. Setting the goal of scientific research in the field of technology of inorganic compounds. Methodology of planning and research setting. Acquisition of skills to independently carry out research work in accordance with the task and research stages.		v	v					v		v	
69	Module of Acquisition of New Professional Competencies	BD	EC	Subjects on the Additional Educational Program	**Goal:** Formation of additional competencies in the field of physicochemical and technological bases of inorganic technologies. **Contents:** Program of additional training direction, which a student chooses from the Catalog of educational Minor programs. Upon completion of the full curriculum on additional educational Minor	12				v	v			v		

					program, a graduate is issued a diploma supplement on additional educational program (Minor) in accordance with the established form.											
70	Module of Final Attestation	PD		Pre-degree or Industrial Practice	**Goal:** Improving the knowledge and skills of students in the specialty, checking the possibility of future specialist independent work in a definite enterprise conditions; obtaining materials for a final qualification work. **Contents:** Acquisition of practical skills in analysis of production technology, the principle of equipment operation, calculation of mass and heat production flows. Solving problematic issues, suggesting ways to solve them; planning and organization of production, introduction of new equipment and technology, possibility of improving the economic indicators of production.	10		v			v				v	v
71				Writing and Defending a Thesis, a Graduate Work, or Preparing and Passing a Comprehensive Exam	**Goal:** Development of theoretical and practical skills of independent and creative work using scientific approaches to research activities. **Contents:** Acquisition of practical skills in conducting an analytical review and patent search, performing experimental or design work, processing, discussing research results and drawing conclusions, independently presenting the researched	8	v				v	v	v	v	v	v

					technology. Formation of skills to choose ways to improve existing technologies and technological processes to ensure high quality of products.											

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	
			OC	HSC	EC	Theoretical training	Physical training	Study practice	Industrial practice	Final attestation			exam	Diff. pass
1	1	7	5	2	-	27	2	-	-		870	29	5	1
	2	8	4	2	2	29	2	-	-		930	31	6	2
2	3	8	3	3	2	28	2	-	-		900	30	6	3
	4	7	-	2	5	24	2	-	4		900	30	5	2
3	5	7	-	1	6	29		-			870	29	6	1
	6	7	-	2	5	25		-	6		930	31	3	1
4	7	4	-	-	4	21		-	-		630	21	4	-
	8	4	-	-	4	21		-	-		630	21	4	-
	9	2						-	10	8	540	18	-	1
Total			8	12	28	204	8	-	20	8	7200	240	39	11

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

Learning strategies	**Student-centered learning:** the learner is the center of teaching/learning and an active participant in the learning and decision-making process. **Practice-oriented learning:** focus on the development of practical skills.
Learning methods	Conducting lectures, seminars, various types of practices with: • application of innovative technologies: - problem learning; - case study; - work in groups; - discussions and dialogues, intellectual games, business games; - virtual laboratory work; - methods of reflection, projects; - presentations; • rational and creative use of information sources: - multimedia training programs; - electronic textbooks; - video lectures, video films;

	- digital resources; - machine learning methods. Organization of independent student work, individual consultations.
Monitoring and assessing the achievability of learning outcomes	**Current control** on each topic of a discipline, control of knowledge in in-classand out-of-class activities (according to a syllabus). Assessment forms: • questioning in the classroom; • testing on the topics; •test; • defending student independent works; • virtual laboratory work; • discussions; • trainings; • colloquia; • essays, etc. **Midterm control:**at least two times during one academic period within each academic discipline. **Intermediate attestation**is carried out in accordance with the working curriculum, academic calendar. Conduct forms: • exam in the form of testing; •oral exam; •written exam; • combined exam; • defense of term works/projects; • defense of practice reports. **Final state attestation:** defense of a thesis or passing a comprehensive exam.

7 EDUCATIONAL AND RESOURCE SUPPORT FOR EP

Information Resource Center	There are 6 library departments, 16 reading rooms, 2 electronic resource centers (ERC) in the structure of the Information Resource Center. The network infrastructure of the IRC is based on 180 computers with Internet access, 110 workstations, 6 interactive whiteboards, 2 video doubles, 1 video conferencing system, 3 A-4 format scanners. The IRC software includes AIBS “IRBIS-64” for MS Windows (the basic set consisting of 6 modules), stand-alone server for uninterrupted operation in the IRBIS system. The library fund is in the electronic catalog available to users on the site http://lib.ukgu.kzon-line 24 hours 7 days a week. Own thematic databases have been created: “Almamater”, “Proceedings of SKU scientists”, “Electronic archive”. Online access from any device in 24/7 mode via an external link http://articles.ukgu.kz/ru/pps. Work with catalogs in electronic form. The Electronic Catalog consists of 9 databases: “Books”, “Articles”, “Periodicals”, “Proceedings of the SKU teaching staff”, “Rare Books”, “Electronic Fund”, “SKU in Print”, “Readers”, and“South Kazakhstan Oblast”. The IRC provides its users with 3 options for accessing their own electronic information resources: using the “Electronic Catalog”

	terminals in the catalog hall and in the IRC subdivisions; through the information network of the university for faculties and departments; remotely on the library website http://lib.ukgu.kz/. Open access: to international and republican resources: “SpringerLink”, “Polpred”, “Web of Science”, “EBSCO”, “Epigraph”; to electronic versions of scientific journals in the public domain, “Zan”, “RMEL”, “Adebiet”, Digital library “Aknurpress”, “Smart-kitap”, “Kitap.kz”, etc. For persons with special needs and disabilities, the IRC has adapted the library website for the work of visually impaired users.
Material and technical base	The material and technical base of the “Chemical Technology of Inorganic Substances” department includes the following rooms and laboratories for undergraduate students: - laboratories for chemical technology and examination of substances and materials, rooms 312A, 320A (including the discipline “General chemical technology”); - A.S. Seitmagzimov Laboratory for the examination of substances and materials, room 308A; - laboratory for the technology of electrochemical production, room 329A; - lecture classrooms providing with interactive whiteboards, computer classrooms. Students also use the services of general use university laboratories - Testing Regional Laboratory of engineering profile “Construction and Biochemical Materials” and Research and Testing Center SAPA to perform chemical and physico-chemical analysis.