Ф.7.02-09

MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE REPUBLIC OF KAZAKHSTAN

M.Auezov SOUTH KAZAKHSTAN UNIVERSITY

"APPROVED"
Chairman of the board -
Rector _____
Doctor of historical sciences,
Academician Kozhamzharova D.P.
"__" _____ 2023

EDUCATION PROGRAM

6B05330 - Expertize of Substances and Materials in Chemical Engineering

Registration number	6B05300054
Code and Classification of the Field of Education	6B05-Natural Sciences, Mathematics and Statistics
Code and Classification of Training Direction	6B053- Physical and Chemical Sciences
Group of Educational Programs (EP)	B053 - Chemistry
Typeof EP	*Active*
ISCE level	6
NQF level	6
IQF of education level	6
Language of Training	English, Russian, Kazakh
The complexity of the EP, not less	240 credits
Distinctive features of EP	
University Partner (JEP)	
University Partner (DDEP)	

Shymkent, 2023

Authors:

Name	Position	Signature
Seitmagzimova G.M.	C.t.s., professor of TI&PCP department	
Koshkarbayeva Sh.T.	C.t.s., associate professor of TI&PCP department	
Kadyrbaeva A.A.	C.t.s., associate professor of TI&PCP department	
Orynbek A.	Student of ChT-20-14tk group	
Dauletova S.A.	Head oft he Laboratory ofthe Institute ofForensic Expertise in Shymkent, a filial agency of the Republican State Enterprise "Center of Forensic Expertise of the Ministry of Justice of the Republic of Kazakhstan"	Stamp
Zhantasov K.T.	Head of Research laboratory "Inorganic salts, growth stimulants and plant protection" at . M. Auezov SKU, Doctor of Technical Sciences, professor	
Asilov A.A.	General director of LLP "KAZNIICHIMPROJECT"	Stamp

The Education Program was considered at a meeting of the Academic Committee on "Natural Sciences, Mathematics and Statistics" training direction

Minutes № 4А "10" 02 2023.

Chairman of the Committee _____ Madiyarov N.K.

The EP was considered and recommended for approval at a meeting of Educational 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 "23" 02 2023.

Ф.7.02-09

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Chairman of the board -
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Doctor of historical sciences,
Academician, Kozhamzharova D.P.
«___»_____2023

EDUCATION PROGRAM

6B05330 - Expertize of Substances and Materials in Chemical Engineering

Registration number	6B05300054
Code and Classification of the Field of Education	6B05-Natural Sciences, Mathematics and Statistics
Code and Classification of Training Direction	6B053- Physical and Chemical Sciences
Group of Educational Programs (EP)	B053 - Chemistry
Typeof EP	Active
ISCE level	6
NQF level	6
IQF of education level	6
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Approved by the decision of the Academic Council of the University

Minutes № _____ “ _____” _____ 2023.

CONTENTS

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	• 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.
Uniqueness of the EP	• Practice orientation and orientation to the regional labor market and social order through formation of graduate professional competencies, adjusted to stakeholders requirements. •Possibility to obtain integrated knowledge and skills in related areas of knowledge for training chemists-experts proficient in chemical production technology who are in demand on the labor market.
Academic Integrity and Ethics Policy	The university has taken measures to maintain academic honesty and academic freedom, protection from any kind of intolerance and discrimination: • Rules of academic integrity (Order No. 212-нқ dated 10.10.2022); • Anti-Corruption Standard (Order No. 221-нқ dated 07.12.2021). • Code of Ethics (order No. 212-нқ dated 10.10.2022). • Anti-Corruption Policy of the NJSC "M. Auezov South Kazakhstan University." (order No. 144 пқ dated 07.14.2022).
Legal framework for EP development	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 the organization of the educational process on credit technology of training, approved by the Order of the Ministry of Education and Science of the Republic of Kazakhstan dated April 20, 2011 No. 152; 5. Qualification directory of positions of managers, specialists and

	other employees, approved by the Order of the Minister of Labor and Social Protection of the Population of the Republic of Kazakhstan on December 30, 2020 No. 553. 6. Guidelines for the use of ECTS; 7. Guidelines for development of educational programs for higher and postgraduate education, Appendix 1 to anorder of the director of CBP&AM No. 45 o / d dated June 30, 2021.
Organization of the education process	• Implementation of the Bologna Process principles • Student-centered learning • Availability • Inclusiveness
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	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).
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 EDUCATION PROGRAM

EP goal	Training of demanded bachelors with fundamental knowledge and practical skills in the field of expertize of chemical engineering objects.
EP objectives:	•formation of socially-responsible behaviour in the society, understanding the importance of professional ethical standards and compliance with these norms; •provision withskills for lifelong learning that will allow graduates to adapt successfully for varying conditions of the labour market throughout all their professional career; •provision withconditions for acquisition of 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 quality control of materials, products and processes of chemical engineering to ensure possibility of employment in the training direction or continuation of training on master degree programs.
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 communication with the professional sphere	• Attachment No. 2 to the Industry qualifications' framework "Chemical production" confirmed on August, 16th, 2016 (minutes №1) • Professional standard "Quality control of products, processes, services" (Application No. 2 to the order of the Deputy Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken" dated December 30, 2019, No. 270). • Professional standard "Quality control of petroleum, gas and products of their processing" (Application No. 7 to the order of the Deputy Chairman of the Board of the National Chamber of the Republic of Kazakhstan Entrepreneurs "Atameken" dated December 06, 2022, No. 224).
Name of the degree awarded	After successful completion of this EP, the graduate is awarded "Bachelor of Natural Science" in EP 6B05330 – Expertize of Substances and Materials in Chemical Engineering
List of qualifications and positions	•chemical engineer •specialist in quality (products, processes, services) • quality engineer • process engineer for production of chemical products •engineer-technologist in research institutions
Professional area	• research and forensic laboratories of the bodies of internal affairs and expertise of the Ministry of Justice, customs and certification services • Industrial laboratories of chemical enterprises, research institutes, • accredited testing laboratories of the Republic of Kazakhstan.
Objects of	- chemical technology of substances, compounds and materials; - technological scheme of production;

professional activity	- natural and technogenic raw materials; - inorganic and organic substances, compounds and fertilizers; - building materials, solid and liquid fuel; - drinking, industrial and waste water; - analytical instruments, testing and measuring equipment; - methodology for testing and research; - technical regulations for products; - normative and methodical documentation regulating the quality and safety of products, processes and services; - reporting documentation on the results of research and testing.
Subjects of professional activity	- processing of mineral and secondary raw materials, industrial waste; - sampling necessary to fulfill the requirements of technical regulations, standards, contract terms; - technical tests of the studied objects; - assessment of the quality (defectiveness) of raw materials, products and processes; - experimental study of chemicals, compounds and materials; - processing and analysis of test results and research of quality and safety of products and processes; - preparation of reporting documentation on the results of tests and research.
Kinds of professional activity	- scientific-and-research activity; - industrial and technological activity; - organizational and administrative activity.
Learning outcomes	**LO1** Possess information and computing skills, ability to generalize, analyze and apprehend the information; fluently communicate in the professional environment and the society in Kazakh, Russian and English languages. **LO2** Use natural-scientific, mathematical, public, historical, social and economic and engineering knowledge and skills, methods of scientific research in professional activity. **LO3** Know regularities of development ofsociety, Kazakh statehood, demonstrate socio-cultural development based on formation of ideological, civic, spiritual and social responsibility, academic honesty and decency. **LO4** Critically evaluate the current state of production of chemical products, building and textile materials, analyzing and choosing ways to improve existing and develop new technological processes based on modern achievements of science and technology. **LO5** Analyze and choose a rational technological scheme of production based on regularities of processing natural and technogenic raw materials, to calculate technological processes and equipment with development of measures to increase production safety and solve environmental problems. **LO6** Apply normative legal acts, standards and methodical documentation regulating the quality and safety of products and processes to control the quality of products and chemical engineering processes. **LO7** Plan and carry out experimental research with the use of testing and measuring equipment, ensuring normal operation of devices; make conclusions, draw up reporting documentation on the test results. **LO8** Analyze and interpret the results of research and testing using

mathematical methods of data processing to assess product quality, violations in the process and comparing the result with the requirements of regulatory documentation.

LO9 Use research and entrepreneurial abilities and skills of work under conditions of uncertainty; continuously lifelong improve qualification.

LO10 Work effectively individually and in a team, correctly defending their point of view, make independent decisions in problematic industrial situations showing analytical and logic thinking.

LO 11 Freely operate with concepts of criminal, criminal procedure and other industry legislation when performing professional activities.

LO12 Competently apply current legislation and other legal acts to specific circumstances in the field of forensic expertise.

3 COMPETENCIES OF A GRADUATE OF THE EDUCATION PROGRAM

GENERAL COMPETENCIES (SOFT SKILLS). Behavioral and personal skills	
GC 1. Literacy management	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 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 abilitytobe 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. The ability to apply the acquired basic knowledge in the field of chemistry and chemical technology in professional activity; to apply basic concepts, laws and theories to solve chemical and technological problems, the development of mathematical and natural science thinking.
PC 2. Research competence	PC 2. Successfully carry out research work, independently test products or processes based on standard methods and procedural

	documents, analyze the results and draw conclusions about the quality of the studied object in the reporting documentation.
PC 3. Management competence	PC 3. The ability to understand the goals and methods of state regulation of the economy, assess the quality of raw materials and products, make professional decisions in conditions of uncertainty and risk.

3.1 Matrix of correlation of EP learning outcomes as a whole with formed competencies

	LO 1	**LO 2**	**LO 3**	**LO 4**	**LO 5**	**LO 6**	**LO 7**	**LO 8**	**LO 9**	**LO10**	**LO11**	**LO12**
GC 1	+					+	+		+	+	+	+
GC 2	+		+						+	+	+	
GC 3	+	+			+	+		+				
GC 4	+	+					+	+				
GC 5		+	+							+		+
GC 6		+		+	+		+		+	+		
GC 7			+							+	+	+
PC 1		+		+	+	+		+			+	+
PC 2				+		+	+	+	+		+	
PC 3									+	+		

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

№	Module title	Cycle	Component	Component title	Brief discipline description	N. cred	Formed LO (codes)											
							LO 1	LO 2	LO 3	LO 4	LO 5	LO 6	LO 7	LO 8	LO 9	LO 10	LO 11	LO 12
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	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	4		**v**	**v**							**v**		

					society. To understand and use the methods of sociological, comparative analysis, the meaning and content of the political situation in the modern world.													
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.	4		v	v							v		
5	Socio-ethnic Development	GED	HSC	Ecosystem and Law	**Goal:** Formation of integrated knowledge in the field of economics, law, anti-corruption	5		v	v		v							

					culture, ecology and life safety, entrepreneurship. **Contents:** Fundamentals of safe human-nature interaction, ecosystem and biosphere productivity. Entrepreneurial activity in conditions of limited resources, increasing the competitiveness of business and national economy. Regulation of relations in the field of ecology and human life safety. Knowledge and compliance of Kazakhstan's law, obligations and guarantees of subjects, state regulation of public relations to ensure social progress. Application of scientific research methods.													
6		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	3			v									

					«Abai and Kazakhstan in the XXI century», role, significance.														
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 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.				v									
8		BD	EC	Actual Problems and Modernization of Public Consciousness	**Goal:** Restoration of spirituality, deformed during periods of tsarist and Soviet reality, formation of a creative personality based on modernization of young people public consciousness. **Contents:** Spiritual modernization: origin and background. Modern national identity. Pragmatism and competitiveness. National identity and national code. Experience and prospects of evolutionary development. The triumph of knowledge and openness of consciousness. Alphabet Reform:				v									

					Experience and Priorities. Fatherland is the basis of the state. Education through nationwide sacred places and history. Modern Kazakh culture is the cornerstone of spiritual revival. New humanitarian education and the future national intelligentsia. Abai Kunanbaev and Kazakh society.														
9		BD	EC	Foundations 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 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.				v									
10		BD	EC	Service to Society	**Goal:** Acquaintance with socially useful activities				v										

					Contents: History of formation and development of concept of "Service Learning". Key components of "Service Learning." Social-and-useful activities in children's and youth environment. Organization of volunteer movement in world and Kazakh practice. Service Learning profile focus. Domestic practice of training through socially useful activities. Social design technologies. Preparation of social projects, their analysis and discussion. Implementation of the action plan. Compiling a portfolio. Reflection and further advancement of social project.													
9	Module of Communication and Physical Training	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	10	v		v							v		

					language material in texts on the educational program, knowledge of terminology and development of critical thinking.													
10		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, 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.	10	**v**		**v**							**v**		
11		BD	HSC	Professional Kazakh (Russian) Language	**Goal:** Providing professionally oriented language training for a specialist who is able to adequately build communication in professionally significant situations and who knows the norms of the language for special purposes. **Contents:** Professional language and its components. Professional terminology as the main feature of the scientific style. Scientific vocabulary and scientific	3	V		V									

					constructions in the scientific and professional field. Algorithm of work on the analysis and production of scientific texts. Production of scientific and professional texts. Fundamentals of business communication and documentation in the framework of future professional activities.													
12		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					
13		GED	OC	Information and Communication Technologies	**Goal:** Formation of abilities to critically evaluate and analyze methods of searching, storing and processing information, methods of collecting and transmitting information through digital technologies. Development of new	5	**v**	**v**						**v**		**v**		

					"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.													
14	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, apply them in professional activities.	5	V	V						V				
15		BD	EC	Physics	**Goal:** Formation of physical laws	5		V					V	V		**V**		

					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.													
16		BD	EC	Fundamentals of Quantum Mechanics	**Goal:** Formation of knowledge of laws of heat radiation and quantum theory. **Contents:** Laws and problems of heat radiation, quantum hypothesis and Planck's formula. Conservation laws; approximate methods of quantum mechanics; elements of the theory of radiation. Corpuscular-wave dualism. Phase equilibrium and phase transitions; solid state physics; polarization of dielectrics; superconductivity. Elements of nuclear physics, quantum electronics. The structure of the atomic nucleus. Nuclear fission reactions, radioactive transformations of atomic nuclei.			V					V	V				

17		BD	HSC	Modern Computer Methods for Experimental Data Processing	**Goal:** Instilling skills in automating the calculation processes, processing tabular and graphic dependencies. **Contents:** Fundamentals of planning and conducting an experiment; methods of systematization and processing of experimental data. Compilation of mathematical models; methods of automation of mathematical calculations, methods of data processing in MS Excel, Origin, MathCAD. The use of software resources in construction of empirical regression equations. Solving problems on multifactorial and multigrade regression.	4	V	V						V				
18		BD	EC	Standartization, 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	4						V	V	V				

					measuring instruments. Metrological control of the analysis of raw materials and products in testing laboratories.													
19		BD	EC	Quality Control of Raw Materials and Products	**Goal:** Mastering the methods of quality control of raw materials and target products. **Contents:** Quality control system for raw materials and 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 raw materials, products and production waste. The procedure for assessing the chemical products' compliance with standard requirements. Chemical, spectral, chromatographic and thermal methods of analysis. Analysis and processing of experimental data.							V	V	V				
20	Chemical Engineering	BD	EC	Inorganic Chemistry	**Goal:** Studying basic laws of chemistry, properties of chemical elements and inorganic compounds. **Contents:** Laws of chemistry, dependence of substance properties 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	4				V	V			V				

					technological objects. Skills in applying the Mendeleev periodic law to describe the periodicity of changes in atoms' properties.													
21		BD	EC	Theoretical Foundations of General and Inorganic Chemistry	**Goal:** Formation of knowledge of theoretical foundations in the field of general and inorganic chemistry. **Contents:** Kinetic regularities of chemical reactions. Laws of thermodynamics; entropy, Gibbs energy. Chemical potential, chemical equilibrium, Le Chatelier principle. Acid-base equilibrium in solutions, protolytic theory. Redox processes. Standard electrode potential, Nernst equation. The concept of hybridization of atomic orbitals. Electrolyte solutions: structure of water and aqueous solutions of electrolytes. Formation of skills for solving problems and performing an experiment.					V			V	V				
22		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 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	4					V		V	V				

					qualitative reactions of cations and anions. Method of analytical determination of product composition in technological processes.													
23		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.					V	V							
24		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.	5				V	V			V				

					Compounds of halogens with metals and non-metals. Use of acquired knowledge in analysis of chemical-technological processes.													
25		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								V		
26		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.	6				V	V			V				

					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.													
27		BD	EC	Regularities of Technological Processes	**Goal:** Formation of knowledge of 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.					V	V			V				
28		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	5				V	V			V				

					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 and convective mass transfer. Mass transfer processes: absorption; simple distillation and rectification; liquid extraction; adsorption; drying; crystallization. Calculation of mass transfer apparatuses.													
29		BD	EC	Coke chemistry	**Goal:** Studying the theoretical fundamentals of coal coking and main stages of production. **Contents:** Theoretical fundamentals of coking. Features of thermal destruction of black coal. Temperature mode of coke furnaces. Chemical methods for processing of coke furnace gas components - ammonia, hydrogen sulfide, crude benzene and tar. Acquisition of professional skills in thermal treatment of coking coal. Formation of scientific thinking, understanding the limits of applicability of various laws and theories. Acquisition of skills in technological calculation of the coking process.					V	V					**V**		
30		BD	EC	Industrial Organic Chemistry	**Goal:** Studying the composition, structure, properties and methods of obtaining organic compounds.	4		V			V							

					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. 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.													
31		БД	КВ	Chemistry of Macromolecular Compounds	**Goal:** Studying the composition, properties and regularities of macromolecular compounds synthesis. **Contents:** Chemical properties of macromolecular compounds, molecular weight characteristics of polymers, regularities of synthesis and conversion reactions, chain polymerization processes, behavior of macromolecules in solutions. Mastering the methods of synthesis: polymerization, polycondensation, copolymerization. Relationship between polymer structure and chemical, physical, mechanical properties. Application of knowledge to predict properties of polymers with given properties.			V							V			
32	Module of Introduction	BD	EC	Introduction to Specialty	**Goal:** Familiarization of students with future profession, basic	4		V				V	**V**					

	to Specialty				requirements for bachelor training. **Contents:** Characteristics of the educational program, interdisciplinary connections, qualification characteristics of the Bachelor of Natural Science. Main stages in development of chemical technology and chemical examination of substances and materials, applicable regulatory documents. Contribution of domestic scientists to chemical technology development. Fundamentals of expertise organization. Subject, objects and methods of forensic research. The nature of expert chemist future work, motivation for professional activities.													
33		BD	EC	Fundamentals 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**									

34				Educational Practice	**Goal:** Acquisition of primary professional competencies, practical skills and work skills in accordance with the training program. **Contents:** Acquaintance with main chemical industries, structure and technology of organic and inorganic substances, characteristics of raw materials, requirements for quality of raw materials and products, safe organization of production and environmental protection measures. Acquisition of skills in representing main stages of a chemical production in accordance with an individual assignment for practice.	1		**V**		**V**	**V**							
35	Fundamentals of Specialty	BD	EC	Fundamentals of Forensic Technique	**Goal:** Studying on a scientific basis the means and methods of investigating and solving crimes. **Contents:** Scientific provisions of forensic technology, tools and techniques for the use of special forensic methods to study substances, materials and products. Development of transformed methods. Training in the choice of algorithms for application of special scientific knowledge in forensic photography, traceology, ballistics, fingerprinting, technical-forensic examination of documents, formation of forensic records when obtaining samples for expert examination.	4		**V**					**V**	**V**	**V**		**V**	**V**

36		BD	EC	Qualitative and quantitative analysis	**Goal:** Formation of knowledge of physical-chemical methods of analysis, areas of application and design of devices. **Contents:** Main types of qualitative reactions in analytical chemistry. Thermodynamic and kinetic characteristics of chemical reactions. Essence of gravimetric and titrimetric methods of analysis. The principle of acid-base and redox titrations. Application of methods of quantitative analysis for control of technological processes. Acquisition of practical skills in preparation of standard reagent solutions, identification of inorganic compounds based on qualitative analysis data.			**V**					**V**	**V**				
37		BD	EC	Forensics	**Goal:** Studying the mechanism of crime, methods and means of detecting, disclosing, investigating and preventing crimes. **Contents:** Theory of forensic identification. Investigation of nature objects, subject and functions of the science of detection, fixation, withdrawal, research and use of traces. Forensic photography, forensic examination of documents, forensic habitology, general provisions of forensic tactics, planning of investigation, investigative tactics and crime investigation methods. Formation of skills to study interaction of	5							V	V	V		V	V

					material objects and people.													
38		BD	EC	Fundamentals 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 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.		**V**				**V**			**V**				
39		BD	EC	Technique of Experimental Studies	**Goal:** Formation of skills in organizing experimental research. **Contents:** Planning of experimental work, stages of 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	4							V	V	V			

					formulate conclusions based on experimental results.													
40				Content and Language Integrated Learning	**Goal:** To teach students to express their ideas, scientific developments in writing or orally in three languages. **Contents:** Basic terms used in chemical technology in three languages. Characteristics of chemical-technological processes, target products, mineral raw materials and production wastes, equipment used, presented in Russian, Kazakh and English. Formation of free dialogue skills on professional topics, understanding and translating abstracts and short texts on a subject of scientific direction.		V			V					V			
				Industrial Practice I	**Goal:** Consolidation of theoretical knowledge on main regularities of of technological processes, studied in general engineering disciplines. **Contents:** Practical consolidation of knowledge of main regularities of technology at chemical enterprises, main methods of processing mineral raw materials and production waste. Technological schemes and technological regulations of production. Application in practice of knowledge of technological equipment operation, requirements for environmental safety of production, solving problematic	4				**v**	**v**	**v**				**v**		

					production issues.													
41	Technology of Chemical Productions	BD	EC	Examination of Raw Materials in Chemical Engineering	**Goal:** Acquisition of knowledge about methods of expert research of raw materials in chemical engineering. **Contents:** Methods of quality control of raw materials, algorithm for selecting and preparing raw materials for examination. Solving diagnostic problems in the process of expert examination of raw materials by a combination of means, types, methods of examination and identification of raw materials for the purposes and objectives of the conduct. Classification of natural raw materials on their qualitative characteristics, training in the choice of analysis methods, detection of product falsification.	4		**V**				**V**	**V**	**V**				
42		BD	EC	Mineral Raw Materials of Kazakhstan	**Goal:** Formation of representations about mineral resource base of Kazakhstan. **Contents:** Geographical location of minerals in Kazakhstan's territory, their characteristics. Their role in innovative development of Kazakhstan. Share of natural reserves in world resources. Conditions of occurrence and availability for development. Calculation of mineralogical composition of raw materials. Ore and non-ore raw materials, hydrocarbon raw materials and fuel						V			V				

					resources. Characteristics and reserves of uranium and phosphate ores. Ways to solve urgent problems of raw materials processing.													
43		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			
44		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,						V		V	V				

					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.													
45		SD	EC	Technology of Mineral Fertilizers	**Goal:** Study of technologies of phosphoric, nitric, potash and complex 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.	5				V	V	V		V		V		
46		SD	EC	Food and Feed Phosphate Technology	**Goal:** Study of composition and 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					V	V	V		V				

					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.													
48		SD	EC	Examination of Household Chemical Products	**Goal:** Theoretical study and practical development of methods for examination of household chemicals. **Contents:** Evaluation of quality of synthetic and other detergents. Methods for examination of products, their main consumer properties: functionality, ergonomics, reliability, aesthetics, safety. Formation of skills to perform chemical examination of household chemicals to determine compliance with standards, formulate a conclusion on composition of an object under study; process the obtained experimental data; apply skills in professional activities as an expert.	5				**V**	**V**	**V**	**V**					
49		SD	EC	Examination of Metals and Metal Products	**Goal:** Practical development of methods of examination of metals and metal products. **Contents:** Composition, physico-chemical properties and main characteristics of metals; manufacturing methods and scope.								V	V		V		

					Analysis of strength characteristics, corrosion resistance of metals and metal products. Conducting an examination to identify the nature and source of origin of the metal; specific chemical composition of metals. Acquisition of skills for independent examination of metal products and execution of an expert conclusion.													
50		SD	EC	Examination of Mineral Fertilizers and Salts	**Goal:** Study of objects of expertise - one-component and complex mineral fertilizers, technical and reactive inorganic salts. **Contents:** Determination of composition, quality and origin of mineral fertilizers and salts, compliance with requirements of standards. Determination of quantitative and qualitative changes in mineral fertilizers and salts after storage. Formation of skills for conducting of complex chemical examination of products, formulating conclusions and presenting in the form of an expert opinion.	6						V	V	V				
51		SD	EC	Materials Science	**Goal:** Study of relationship between structure and properties of solid materials. **Contents:** Types of chemical bond. Aggregate state of materials, crystalline, amorphous and amorphous-crystalline bodies. Hardness, elasticity, plasticity, strength. Ultimate strength in								V	V				

					tension, compression and static bending. Electric conductivity of dielectrics, essence of polymerization and polycondensation, properties of semiconductor materials, mechanisms of intrinsic and impurity conductivity. Mastering the methods for determining and calculating strength indicator of materials.													
52		SD	EC	Examination of Objects of Soil Origin	**Goal:** Study of soil properties, mechanism of formation of soil layers on carrier objects, training in methods for analyzing composition and structure of a soil sample. **Contents:** Mechanism of formation of soil depositions on carrier objects. Conducting identification studies: establishing the nature of soil layers, belonging of layers on objects to a specific area; establishing the soil origin, region, time and mechanism of formation of depositions. Formation of skills in analysis of soil composition and structure, environmental characteristics of soils, registration of examination results.	5						V	V	V			V	V
53		SD	EC	Energy-Technological Systems in Chemical Engineering	**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					V	V			V				

					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.													
54		BD	EC	Physical Methods of Research and Control	**Goal:** Formation of knowledge in the field of modern methods for study of inorganic materials, acquisition of skills in working with instruments and processing experimental data. **Contents:** Instrumental methods for analysis of substances and materials: X-ray phase, chromatographic, electron microscopic, atomic absorption, sedimentation, infrared microscopy; construction and principle of operation of devices. Mastering the methods of analysis; identification of chemical and mineralogical composition of compounds, study of structure and morphology of materials, specific surface of particles of dispersed materials.	4		**V**					**V**	**V**				
55		BD	EC	Electroplating Technology	**Goal:** Acquisition of knowledge on obtaining coatings of various					V		V					

					metals by electroplating. **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.													
56				Industrial Practice II	**Goal:** Consolidation of theoretical knowledge and practical skills in studied special disciplines; collection of material for implementation of course projects and works. **Contents:** Acquaintance with technological regulations, standards and contracts for testing. Mastering the practical skills of conducting technological expertise at individual stages of production, performing experimental expert work in a scientific chemical laboratory in compliance with safety regulations.	6					**v**	**V**	**v**		**v**	**v**		

57	Module of Examination and Research	SD	EC	Examination of Inorganic Components in Agricultural Products	**Goal:** Acquisition of knowledge on bases of agricultural products' examination and examination implementation for practical purposes. **Contents:** Chemical composition, quality and safety of agricultural products. Analysis of content of nitrates, phosphates, chlorides, sulfates, macro and microelements in plant foods; impact of their excess on human health. Formation of skills to examine agricultural products for content of harmful and toxic components, analysis of the results and preparation of an expert report.	5						V	V	**V**	V			
58		SD	EC	Environmental Problems in Chemical Engineering	**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.					V	V					V		
59		BD	EC	Examination of Industrial and	**Goal:** Acquisition of knowledge and skills in conducting an	4						**V**	V	V	V			

				Drinking Water	examination of water for industrial and drinking purposes. **Contents:** Composition and properties of water; modern requirements for quality of water for industrial and drinking purposes. Methods for conducting an examination to assess the compliance of water quality with normative indicators, determined depending on direction of their intended use, including instrumental physico-chemical, chemical, biological and organoleptic methods for analyzing water quality indicators.													
60		BD	EC	Chemical Laboratory Safety	**Goal:** Assimilation of the system of knowledge and skills for preparation, performance of basic operations preceding or accompanying the conduct of laboratory research. **Contents:** Requirements for safe work in a chemical laboratory, handling reagents and chemical waste. The use of personal protective means, training in safety, electrical safety and fire safety, record keeping in the laboratory. Acquisition of skills for the safe handling of chemical materials, first aid in case of accidents, elimination and prevention of emergency situations.							V	V	V				
61		SD	EC	Examination of Construction	**Goal:** Study of methods for examination of silicate and building	5							V	V		V	V	V

				and Silicate Materials	materials. **Contents:** Physico-chemical features of production of silicate products and composite materials. Analysis of physico-mechanical properties of cements and building materials, determination of the setting time, volume change, flexural and compressive strength and the content of alkali and alkaline earth metals. Formation of skills for independent examination of silicate and building materials, determination of quality indicators and content of basic compounds, execution of an expert conclusion.													
62		SD	EC	Fundamentals of New Materials Technology	**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 purposes, improving characteristics of materials as a result of processing. Analysis of the structure of materials by X-ray phase, spectroscopic, electron microscopic methods.					V	V		V					
63		SD	EC	Solid Fuel	**Goal:** Study of methods for	6						V	V	V			V	V

				Examination	determining the brand and assessing the consumer properties of solid fuels according to their compliance with standard requirements. **Contents:** Characteristics of solid fuel, physico-chemical methods for analyzing the composition of black and brown coal and coke. Analysis of the quality of initial coal, coke and by-products of coking for content of sulfur, ash, moisture, combustible components, benzene, tar and ammonia. Acquisition of skills in examination of solid fuel for compliance with standard requirements.													
64		SD	EC	Examination of Petroleum Products and Fuels and Lubricants	**Goal:** Study of methods for examination of petroleum products and fuels and lubricants. **Contents:** Chemical and physico-chemical analysis of oil and oil products to determine the brand and type, conducting a comparative investigation. Formation of skills for independent examination of oil, oil products and fuels and lubricants and execution of an expert opinion. Finding trace amounts of oil products and fuels and lubricants in the analyzed objects with their subsequent identification.							V	V	V		V		V
65		SD	EC	Examination of Alcohol and Alcohol-	**Goal:** Formation of theoretical knowledge and practical skills necessary for research and	5						V	V	V				V

				Containing Liquids	examination of alcohols and alcohol-containing liquids. **Content:** Formation of the skills necessary for production of forensic examinations of alcohol-containing liquids. Technologies and recipes for handicraft and factory production of alcohol-containing liquids. Training in methods of qualitative and quantitative analysis of samples, expert examination of alcohol-containing liquids using chemical and physico-chemical methods. Drawing up an expert conclusion on the results of the study.													
66		SD	EC	Examination of Mineral Acids and Alkalis	**Goal:** Study of methods for conducting examination of inorganic acids and alkalis of technical and reactive qualification. **Contents:** Research of chemical composition of inorganic acids and alkalis by chemical and physico-chemical methods. Expert assessment of compliance of the studied samples' quality with standard requirements for a product of a certain brand and variety. Training for independent conduct of a comprehensive examination of chemical products in terms of quality and origin, preparation of an examination report.							V	V	V		V		V
67		SD	EC	Examination of Paintwork Materials and	**Goal:** Formation of deep knowledge, stable practical skills and abilities necessary for	5						V	V	V			V	V

				Coatings	conducting research on paints and varnishes and coatings. **Contents:** Properties of paintwork materials, the effect of various factors on paintwork coating quality. Experimental analysis of physical-mechanical, chemical, protective and anti-corrosion indicators of paint and varnish coatings. Consideration of typical tasks of examination and mastery of modern methods of their solution. Formation of practical skills for examination of paints and varnishes and coatings and analysis of examination results.													
68		SD	EC	Examination of Fibrous Materials	**Goal:** Formation of knowledge and practical skills necessary to perform an expert research of fibrous materials. **Content:** Establishment of factual data indicating a connection with the investigated event of fibrous nature objects and their residues. Training in performing an expert investigation of fibers and fibrous materials by microscopic, spectral, chromatographic and mass spectral methods. Formation of skills for independent conduct of expert research on the detection of microparticles of fibrous materials at an object, their belonging and preparation of an expert report.					V			V	V			V	V
69		SD	EC	Student Study Research Work	**Goal:** Training in organization, planning and implementation of	6							V	V	V	V		

					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 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.													
70		SD	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			V		V			V		V	V		

					work in accordance with the task and research stages.													
71	Module of Acquisition of New Professional Competencies	BD	EC	Subjects on the Additional Educational Program	**Goal:** Formation of additional competencies in the field of bases of forensic examination, use of special scientific knowledge in the field of criminal, civil and administrative processes. **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 program, a graduate is issued a diploma supplement on additional educational program (Minor) in accordance with the established form.	12												v	v
72	Module of Final Attestation			Predegree or Industrial Practice	**Goal:** Improving the knowledge and skills of students in the specialty, checking the possibility of future specialist independent work as an expert; obtaining materials for a final qualification work. **Contents:** Acquisition of practical skills in performing chemical examination and quality control of studied products for compliance with standard requirements, product safety in a research, forensic or testing laboratory. Processing of research results and execution of expert assessment in the form of a report.	10						V	v	V	v	v		

73				Writing and Defending a Thesis, a Graduate Work, or Preparing and Passing a Comprehensive Exam	**Goal:** Development of theoretical-practical skills of independent and creative work using scientific approaches to research activities. **Contents:** Acquisition of practical skills to conduct an analytical review and patent search, to perform an experimental investigation of the object under study, to process and discuss research results and make conclusions about the quality and safety of a product or process, independently presenting an expert assessment in the form of a conclusion.	8					v	v	v	v	v	v		

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

Course of Study	Semester	The number of mastered modules	The number of studied disciplines			Number of KZ credits					Total hours	Total KZ credits	Number of	
			OC	UC	EC	Theoretical training	Physical training	Study practice	Industrial practice	Final attestation			exam	Diff. pass
1	1	7	5	2	-	28	2	-	-		900	30	6	1
	2	7	4	-	3	27	2	2	-		900	30	5	2
2	3	8	3	2	3	28	2	-	-		900	30	6	2
	4	6	-	1	5	24	2	-	4		900	30	5	2
3	5	7	-	1	6	30		-			900	30	5	2
	6	7	-		7	24		-	6		900	30	7	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	6	32	203	8	1	20	8	7200	240	42	11

6 LEARNING STRATEGIES AND METHODS, MONITORING AND EVALUATION

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, benchmarking; - presentations; • rational and creative use of information sources: - multimedia training programs; - electronic textbooks;

	- video lectures, video films; - digital resources. 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 OF THE EDUCATION PROGRAM

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

	theirown 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 310A, 311A, 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, 320A, 330A. 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.

APPROVAL SHEET

on the Educational program "6B05330 - Expertize of Substances and Materials in Chemical Engineering"

Director of DAI	_____	Naukenova A.S.
Director of DASc	_____	Nazarbek U.B.
Director of DI&C	_____	Bazhirov T.S.