Geology and Oil-gas Business Institute named after K. Turyssov
Department of Chemical and Biochemical Engineering

EDUCATION PROGRAM

6B07125 – CHEMICAL TECHNOLOGY OF ORGANIC SUBSTANCES

Code and classification of the field of education: 6B07 Engineering, manufacturing and construction industries

Code and classification of areas of study: 6B071 Engineering and Engineering (0710)

Group of educational programs: 6B060 Chemical engineering and processes

Уровень по НРК: **6**

Уровень по ОРК: **6**

Year of study: **4**

Credits: **240**

Almaty, 2022

Educational program 6B07125 - Chemical technology of organic substances

approved at a meeting of the Academic Council of KazNITU named after. K.I. Satpaeva.

Protocol No. _13_ dated "_28_" _04_2022

Considered and recommended for approval at a meeting of the Educational and Methodological Council of KazNITU named after. K.I. Satpaeva.

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Educational program 6B07125 -Chemical technology of organic substances was developed by the academic committee in the direction «B060 — «Chemical engineering and processes»»

Name	Academic degree/ academic title	Job title	Place of work	sign
Chairman of the academic committee:				
Amitova Aigul Amantayevna	PhD	Head of the Department	KazNRTU	
Teaching staff:				
Selenova Bagdat Samatovn	Doctor of Chemical Sciences, Professor	Professor	KazNRTU	
Kerimkulova Aigul Zhadyraevna	Candidate of Chemical Sciences	Assistant Professor	KazNRTU	
Nauryzova Saule Zinagievna	PhD	Associate Professor	KazNRTU	
Chugunova Nina Ivanovna	Candidate of Chemical Sciences	Associate Professor	KazNRTU	
Nakan Ulantai	PhD	Associate Professor	KazNRTU	
Ilyin Alexander Ivanovich		Chairman of the Management Board	JSC "Scientific Center of Anti-infectious Drugs"	
Employers:				
Minzhulina Olga Vasilyevna		Head of Production	Spira-Berga LLP, +77772992140	
Rauken Kanat Kabdollayevich		Acting Deputy Chief Technologist	Atyrau Oil Refinery LLP	
Tolkimbayev Gambit Ajdarovich		General manager	Oil and Gas Chemical Association	

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List of abbreviations and designations

1. Description of educational program

The educational program (hereinafter EP) is a set of documents developed by the Kazakh National Research Technical University named after K.I. Satpayev and approved by the Ministry of Education and Science of the Republic of Kazakhstan. The EP takes into account the needs of the regional labor market, the requirements of government agencies and relevant industry requirements. The branch of organic and petrochemical synthesis, which uses oil, gas, coal as raw materials, is the leading one and determines the progress of the chemical industry - an important link in the economy of Kazakhstan. Products of organic and petrochemical synthesis, having valuable chemical and physico-chemical properties, are semi-products in the production of polymers, medicinal substances, plant protection products and other synthetic materials. And since the industry of organic and petrochemical synthesis provides raw materials for all other sub-sectors of the chemical industry that produce synthetic materials, it must develop at a faster pace.

The EP is based on the state educational standard for higher professional education in the relevant field.

The EP defines program educational goals, student learning outcomes, necessary conditions, content and technologies for the implementation of the educational process, assessment and analysis of the quality of students during training and after graduation.

The EP includes the curriculum, the content of disciplines and learning outcomes and other materials to ensure a quality education for students.

2. Purpose and objectives of the educational program

The purpose of the EP: Training of specialists with key and professional competencies in the field of production of organic substances, processing of oil, gas, coal and polymers, elastomers, paints and varnishes.

The objectives of this EP are:

- social, humanitarian and professional training of bachelors in the field of chemical engineering in accordance with the development of science and production, as well as with the needs of oil and gas chemical clusters in Kazakhstan, national research centers, master's and doctoral studies of higher educational institutions;

- training of bachelors - technologists who know the raw material base, methods of analytical quality control of raw materials and commercial products, production technologies and areas of consumption of organic substances and materials with fundamental training in physics, mathematics,

chemistry, physical and chemical foundations of technologies for obtaining the most important classes of organic substances, production of chemical reagents (additives, surfactants, polymers) used in the production of fuels and petroleum oils, in the processes of extraction, preparation and transportation of hydrocarbon raw materials.

– providing knowledge, skills and abilities that allow analyzing problems in the field of chemical engineering and finding ways to solve them, solve engineering problems in the design of production of organic substances and materials, conduct research work in the field of synthesis and study of the properties of new chemical compounds and materials using information technologies and methods of mathematical planning of experiment.

- preparation of students for professional activities in the conditions of existing production, the formation of skills and abilities to maintain the required level of labor and production discipline; on conducting a technical and economic analysis of production; on the adoption and implementation of management decisions in the face of different opinions.

3. Requirements for evaluating the learning outcomes of an educational program

Formed learning outcomes:

RO1 to master the specialized vocabulary necessary for the implementation of effective oral and written communications in a foreign language in their professional activities;

RO2 to use the basic provisions and methods of social, humanitarian and economic sciences in solving social and professional problems;

PO3 demonstrate a high level of professional knowledge in the field of technology of organic substances and process equipment and the principles of its operation;

PO4 know the systems and methods for designing technological processes and production modes; prospects for the technical development of the enterprise;

RO5 be able to use modern information technologies, process information using application programs and databases to calculate the technological parameters of equipment and monitor natural environments;

RO6 develop design estimates for the production of organic substances, analyze alternative technology options of various levels of complexity;

RO understand the impact of engineering solutions in the global, economic, natural and social context; know the trends of social development of society.

4. Passport of the educational program

4.1. General information

№	Field name	Note
1	Code and classification of the field of education	6B07 Engineering, manufacturing and construction industries
2	Code and classification of areas of study	6B071 Engineering and Engineering (0710)
3	Group of educational programs	6V060
4	Name of the educational program	6V07101-KhTOV
5	Brief description of the educational program	The educational program (hereinafter EP) is a set of documents developed by the Kazakh National Research Technical University named after K.I. Satpayev and approved by the Ministry of Education and Science of the Republic of Kazakhstan. The EP takes into account the needs of the regional labor market, the requirements of government agencies and relevant industry requirements.
6	Purpose of the OP	Training of specialists with key and professional competencies in the field of production of organic substances, processing of oil, gas, coal and polymers, elastomers, paints and varnishes.
7	OP type	new
8	NQF level	6
9	ORC level	6
10	Distinctive features of the OP	The EP was developed taking into account the Atlas of new professions and competencies of Kazakhstan in the field of chemical technology of organic substances.
11	List of competencies of the educational program:	KK1.Communicativity QC 2. Basic literacy in natural sciences QC3. General engineering competencies QC4. Professional competencies QC5. Engineering and computer competencies QC6. Engineering and work competencies QC7. Socio-economic competencies
12	Learning outcomes of the educational program:	RO1 to master the specialized vocabulary necessary for the implementation of effective oral and written communications in a foreign language in their professional activities; RO2 to use the basic provisions and methods of social, humanitarian and economic sciences in solving social and professional problems; PO3 demonstrate a high level of professional knowledge in the field of technology of organic substances and process equipment and the principles of its operation; PO4 know the systems and methods for designing technological processes and production modes; prospects for the technical development of the enterprise; RO5 be able to use modern information technologies, process information using application programs and databases to calculate the technological parameters of equipment and monitor natural environments; RO6 develop design estimates for the production of organic substances, analyze alternative technology options of various levels of complexity; RO understand the impact of engineering solutions in the global, economic, natural and social context; know the trends of social development of society.
13	Form of study	Daytime (full-time)
14	Training period	4 years
15	Volume of loans	240
16	Languages of instruction	Kaz, Russian and English
17	Awarded Academic Degree	Bachelor of Engineering and Technology
18	Developer(s) and authors:	in engineering and engineering

4.2. The relationship between the achievability of the formed learning outcomes in the educational program and academic disciplines

№	Name of discipline	Brief description of discipline	Number of credits	Formed learning outcomes (codes)						
				PO1	PO2	PO3	PO4	PO5	PO6	PO7
Cycle of basic disciplines University component										
	Foreign language	English is a discipline of the general education cycle. After determining the level (according to the results of diagnostic testing or IELTS results), students are divided into groups and disciplines. The name of the discipline corresponds to the level of English proficiency.	**10**	**V**						
	Kazakh (Russian) language	When moving from level to level, prerequisites and postrequisites of disciplines are observed.	**10**	**V**						
	Information and Communication Technologies (in English)	The socio-political, socio-cultural spheres of communication and functional styles of the modern Kazakh (Russian) language are considered. The course covers the specifics of the scientific style in order to develop and activate the professional communication skills and abilities of students, allows students to practically master the basics of the scientific style and develops the ability to produce a structural and semantic analysis of the text.	**5**					**V**		

	Modern history of Kazakhstan	Required component. The task of studying the discipline is to acquire theoretical knowledge about information processes, new information technologies, local and global computer networks, methods of information protection; obtaining skills in the use of text editors and spreadsheet processors; creation of databases and various categories of application programs.	**5**		**v**					**v**
	Philosophy	Philosophy forms and develops critical and creative thinking, worldview and culture, provides knowledge about the most general and fundamental problems of being and endows them with a methodology for solving various theoretical practical issues. Philosophy expands the horizon of vision of the modern world, forms citizenship and patriotism, contributes to the education of self-esteem, awareness of the value of human existence. It teaches to think and act correctly, develops the skills of practical and cognitive activity, helps to seek and find ways and means of life in harmony with oneself, society, and the world around.	**5**							**v**
	Module of socio-political knowledge (sociology, political science)	Studying the course contributes to the formation of students' theoretical knowledge about society as an integral system, provides the political aspect of	**3**	**v**						

		training a highly qualified specialist on the basis of modern world and domestic political thought. The discipline is designed to improve the quality of both general humanitarian and professional training of students. Knowledge in the field of sociology and political science is necessary for understanding political processes, for forming a political culture, developing a personal position and a clearer understanding of the measure of one's responsibility.								
	Module of socio-political knowledge (culturology, psychology)	The module of socio-political knowledge (culturology, psychology) is designed to acquaint students with the cultural achievements of mankind, for their understanding and assimilation of the main forms and universal patterns of the formation and development of culture. During the course of cultural studies, general problems of the theory of culture, leading cultural concepts, universal patterns and mechanisms for the formation and development of culture, the main historical stages of the formation and development of Kazakhstani culture are considered.	**3**		**v**					
Cycle of general education disciplines University component										
	Fundamentals of anti-corruption culture	The discipline studies the essence, causes, causes of	**5**		**v**				**v**	**v**

		sustainable development of corruption from both historical and modern points of view. Considers the prerequisites and impacts for the development of an anti-corruption culture. Tracks the development of countering corruption on the basis of social, economic, legal, cultural, moral and ethical norms. She studies the problems of forming an anti-corruption culture based on the relationship with various types of social relations and various manifestations.								
	Fundamentals of Entrepreneurship and Leadership	The purpose of the discipline is to give students knowledge of the theory and practice of entrepreneurial activity, leadership, the skills of their successful application in future professional activities.	**5**			**v**	**v**			
	Ecology and life safety	The discipline studies the foundations of entrepreneurial activity and leadership from the point of view of science and law; features, problematic aspects and development prospects. Considers the theory and practice of entrepreneurship as a system of economic, organizational and legal relations of business structures,	**5**			**v**	**v**			**v**
Cycle of basic disciplines University component										
	Mathematics I	The course is based on the study of mathematical analysis in a volume that allows you to explore elementary functions	**5**		**v**	**v**	**v**			

		and solve the simplest geometric, physical and other applied problems. The main attention is paid to differential and integral calculus. The course program includes differential calculus of functions of one variable, derivatives and differentials, the study of the behavior of functions, complex numbers, polynomials. Indefinite integrals, their properties and methods of calculation. Definite integrals and their applications. Improper integrals.								
	Physics	The course studies the basic physical phenomena and laws of classical and modern physics, methods of physical research, the influence of physics as a science on the development of technology, the relationship of physics with other sciences and its role in solving scientific and technical problems of the specialty. The discipline covers the following sections: mechanics, mechanical harmonic waves, fundamentals of molecular kinetic theory and thermodynamics, electrostatics, direct current, electromagnetism, geometric optics, wave properties of light, laws of thermal radiation, photoelectric effect.	**5**		**v**					
	Mathematics II	The discipline is a continuation of Mathematics 1. The sections of the course include elements	**5**		**v**	**v**	**v**		**v**	

		of linear algebra and analytic geometry. The main questions of linear algebra are considered: linear and self-adjoint operators, quadratic forms, linear programming. Differential calculus of a function of several variables and its applications. Multiple integrals. The theory of determinants and matrices, linear systems of equations, as well as elements of vector algebra. Includes elements of analytical geometry in the plane and in space.								
Cycle of basic disciplines Optional component										
	Engineering and computer graphics	This course is designed to study the design of products in various industries and industries, including metrological equipment, as well as the creation of design documentation. Forms students' practical skills in performing drawing and graphic works on the basis of the relevant State standards "Unified system of design documentation" using computer graphics programs.	5			**v**	**v**	**v**		
	Introduction to the specialty	The purpose of the discipline is to acquaint students who have begun their studies at the university with the basic and basic provisions of the specialty and study program; development of interest in the chosen profession, the formation of students' competence and understanding of the chosen	4			**v**	**v**			

		direction of study, initial professional knowledge about the physical and chemical foundations of the technology of organic substances; formation of technological and ecological thinking among students. The main initial concepts of chemical technology are considered: kinetic laws of chemical transformations, types of reactors and mole balance equations, technological indicators of processes, drawing up technological schemes of chemical processes.								
	general chemistry	The purpose of the course is to study the structure of the periodic system of elements and the main characteristics of elements and their compounds arising from it. The nomenclature of chemical compounds, basic chemical laws and concepts, as well as their application in solving professional problems are considered. Methods for studying the physicochemical properties of substances and the main classes of inorganic compounds.	5		v	v				
	Organic Chemistry I	The purpose of the discipline is the development of a complex of knowledge and scientific ideas about the fundamental theoretical and experimental foundations of organic chemistry of aliphatic compounds; in students gaining knowledge of	6			v	v		v	

		the basic concepts of theoretical organic chemistry, mastering the ability to characterize the structure, physico-chemical properties of organic substances, as well as modern methods for the synthesis of organic substances. The course forms the basis of chemical reactions and methods for the synthesis of organic compounds for the most important branches of the chemical and biochemical industries								
	Organic Chemistry II	The purpose of the discipline is to study the general patterns of the flow of organic reactions of cyclic compounds, such as cycloalkanes, aromatic hydrocarbons, and heterocyclic compounds. Each class of compounds is considered in terms of their chemical structure, isomerism and nomenclature, method of preparation, physical and chemical properties, and scope of their application. In the process of mastering this discipline, the student forms and demonstrates competencies that allow applying the obtained basic scientific and theoretical knowledge to solve scientific and practical problems.	5			**v**	**v**		**v**	
	Physical chemistry (thermodynamics)	To form in students: the ability to understand the physical and chemical essence of processes and use the basic laws of physical chemistry in complex production and technological	5			**v**	**v**		**v**	

		activities. After mastering this discipline, the student must know: the laws of thermodynamics; basic equations of chemical thermodynamics; methods of thermodynamic description of chemical and phase equilibria in multicomponent systems; properties of solutions; fundamentals of electrochemistry; basic concepts, theories and laws of chemical kinetics and catalysis.								
	Physical and chemical methods of analysis	The course is designed to understand the principles of research and experimental work on modern analytical tools and the practical use of the results and data obtained. The purpose of the course is to teach students how to use FCMA to study the properties and composition of new organic materials and substances. The theoretical principles of the methods, methods of computer processing of the results of the experiment are described. Mass Spectrometric Methods. Method of electron paramagnetic resonance (EPR). Method of nuclear magnetic resonance (NMR). radiometric methods.	5			**v**	**v**		**v**	
	Fundamentals of physicochemical analysis of oil refining and petrochemical products	The discipline considers the main physical and chemical research methods used for the analysis of petrochemical synthesis products. The purpose of the course: obtaining the	5			**v**	**v**		**v**	

		theoretical foundations of the methodology for the study of oil and oil products, which consists in using a set of methods for isolating and studying individual components and individual compounds; acquisition of practical skills in standard methods of analysis, separation and study of oil and oil products.								
	Chemical kinetics and catalysis	The purpose of the discipline is to consider the basics of chemical kinetics and catalysis, to give an idea of the mechanisms of chemical reactions. basic laws and regularities that determine the direction and result of processes in homogeneous and heterogeneous systems, methods of analytical representation of these regularities. The educational material contributes to the expansion of students' knowledge about the catalysis of chemical reactions, the difference and the basic principles of homogeneous, enzymatic and heterogeneous catalysis. During the study of the discipline, the skills of experimental determination and calculation of the rates of chemical transformations, the study of the nature of the catalytic action and intermediate compounds of reagents with a catalyst are instilled.	5			**v**	**v**		**v**	
	General chemical technology	The purpose of the course: the study of the general patterns of	5			**v**	**v**		**v**	

		the flow of chemical-technological processes (CTP) of the most important chemical industries. The course examines the patterns of chemical transformations in industrial production; basic chemical equipment. Calculation of technical and economic indicators of the process, material and energy balances. industrial catalysis. Basic mathematical models of chemical reactors. Methods for the development of effective chemical-technological processes and systems, methods of energy and resource saving, environmental protection.								
	Theoretical Foundations of the Technology of Organic Substances	As part of the course, the student will master the theoretical foundations of modern processes for obtaining organic products based on hydrocarbon raw materials: thermodynamic and kinetic laws, the mechanism of chemical reactions, including catalytic ones, as well as issues of synthesis and analysis of chemical-technological systems of organic synthesis. As a result of studying the course, the student must know the basics of the theoretical laws of designing production processes; methods of analysis and optimization of chemical-technological systems of basic and fine organic synthesis, determination of tactics and strategy of organic	5		**v**	**v**	**v**		**v**	

		synthesis								
	Fundamentals of quality control of organic compounds	The course summarizes data on the organization and conduct of elemental quantitative analysis of organic compounds. As well as the use of analytical chemistry methods for determining the elements of organogens, halogens and some heteroelements and organic compounds in various other objects. The purpose of this course is: the formation of an active position among students and the development of initiative in solving various problems arising in the process of analysis, the development of the ability to present chemical analysis from sampling to the final result as a single technological process using modern methodology.	5			v	v		v	
	CAD Chemical Engineering I	The purpose of studying the discipline is to develop the ability to create effective and optimal technologies for various chemical processes using the CemKad modeling computer program. The questions considered in the course are the study of the regularities of hydromechanical and heat exchange processes occurring in various systems, and the development of various calculation methods. Calculation technique for chemical technology devices using a simulation program. The course	5			v	v	v	v	

		forms the student's ability to perform engineering and technological calculations using a computer simulation program, stimulates the creation of various projects.								
	Instrumentation for the production of organic substances I	Formation of students' understanding of the regularities of hydromechanical and heat exchange processes occurring in systems with several phases and several components and development of methods for calculating equipment, choosing a rational design and determining the size of devices. As a result, the student develops competencies that allow to make calculations of processes and devices of hydromechanical and heat exchange processes, to perform constructive calculations of devices.	5			v	v	v	v	
	Chemistry of macromolecular compounds	The purpose of the discipline is to study by students the main directions of the modern development of chemistry and physics of polymers. Course Outline: General concepts and terminology in the field of polymers. Molecular mass characteristics of polymers. Regularities of the chain mechanism of polymer synthesis. Radical and ionic polymerization, copolymerization. Stepwise mechanism of polymerization. Polycondensation and polyaddition. Chemical	5		v	v	v			

		modification of polymers. Physics of polymers. Flexibility of macromolecules. Molecular and supramolecular structure of polymers. Deformation properties of polymers. Thermomechanical method for studying polymers. Features of polymer dissolution								
	Processing technology of hydrocarbon raw materials I	The purpose of the discipline is to provide students with the necessary professional competencies in the field of chemical technology for the secondary processing of hydrocarbon raw materials. As a result of studying the discipline, the student must: - know the basics of managing chemical and technological processes for processing products of primary oil and gas processing; - have the skills to study the physical and chemical properties and composition of raw materials and the quality of hydrocarbon raw materials processing products; - be able to make specific technical decisions in the development of technological processes;	5			v	v		v	
	Technology of organic and petrochemical production	To form in students a body of knowledge about the methods of conducting production processes, scientific thinking about understanding the logical connection between the chemical structure and reactivity of organic compounds, the processes of their processing,	5			v	v		v	

		leading to a radical change in their properties. Creation of the basics of theoretical training for students to solve practical problems in the field of basic organic and petrochemical production								
	CAD Chemical Engineering II	The purpose of the discipline is the study of modeling chemical-technological processes using the AspenHysys modeling software package. The course studies the basic concepts of the modeling method, methods for constructing a technological scheme, characteristics of a technological scheme and flows, calculation of the parameters of all flows and equipment. The course forms the ability to develop the optimal technology of a chemical process with a high-quality yield of the target product.	5			**v**	**v**	**v**		
	Hardware design of production of organic substances II	The study of patterns and mathematical description of mass transfer processes occurring in systems with several phases and several components. The essence and theoretical foundations of the main processes of chemical technology. Mass transfer processes, calculation and selection of devices and structures. Comparative analysis of the operation of devices, finding the optimal conditions for carrying out technological processes. Methods for	4			**v**	**v**	**v**		

		calculating the main processes and apparatuses.								
	Economic aspects of organic production technology	The purpose of the discipline is to form in students a body of knowledge about the methods of conducting production processes, scientific thinking about understanding the logical connection between the chemical structure and reactivity of organic compounds, the processes of their processing, leading to a radical change in their properties. Creation of the basics of theoretical training for students to solve practical problems in the field of basic organic and petrochemical production.	5				v			v
	Automation of control systems in chemical-technological processes	The purpose of studying the discipline is to acquire the knowledge necessary for effective use in the development of modern automatic control systems. Gaining skills in building and researching mathematical models. Possession of TAR sections necessary for solving research and applied problems. The course "APCS" provides a presentation of the sections of the basics of TAP, measuring elements, actuators, functional diagrams. The study of this discipline will allow the student to acquire the skills to choose the types of switching devices and regulators depending on the law of regulation, to develop a	6			v	v	v		

		functional and mathematical model of the control system, to analyze the operation of the system based on quality indicators of regulation.								
	Automation of control systems	The purpose of studying the discipline is to form students' knowledge, skills and gain experience in the development, research and operation of modern automated process control systems, the theory and practice of these systems, as well as the assimilation of the principles of construction, technical base, mathematical and information support for automation of control systems and further use of this knowledge in future professional activities. Objectives of the discipline: - study of the basic principles of preparation of technological processes and industries for automation;	6			v	v	v		
Cycle of major disciplines University component										
	Technology of production and processing of polymers	The discipline "Technology of production and processing of polymers" includes the study of methods for implementing technological processes for obtaining the main types of polymerization, polycondensation and chemically modified polymers and polymeric materials based on them. As a result of studying this discipline, students should have: an idea of: modern	4			v	v		v	

		technologies for the production and processing of polymers know: the physical and chemical bases of polymer processing.								
	Enterprise Design Fundamentals	The purpose of the discipline is to study the structures, the principle of operation of the main and special equipment for chemical production, familiarization with its main components and details. At the end of the course, the student should know the basic principles of designing and developing a feasibility study for production; parameters and modes of operation of typical equipment; typical processes of chemical technology, corresponding apparatuses and methods of their calculation; requirements for the technical condition of the equipment; methods of technological calculations of individual components and parts of chemical equipment.	5				v	v	v	
	Processing technology of hydrocarbon raw materials II	The purpose of the discipline is to provide students with the necessary professional competencies in the field of chemical technology for the secondary processing of hydrocarbon raw materials. As a result of studying the discipline, the student must: - know the basics of managing chemical and technological processes for processing products of primary oil and gas processing; - have the skills to study the physical	4			v	v		v	

		and chemical properties and composition of raw materials and the quality of hydrocarbon raw materials processing products; - be able to make specific technical decisions in the development of technological processes.								
	Equipment for organic synthesis enterprises	The course provides students with a holistic perception of the complex of technological knowledge in the field of equipment and technological production of organic synthesis. The course develops the following skills for students: drawing up the composition of the project (working draft), design estimates, the grounds for its development, the organizational foundations for designing enterprises of organic synthesis and polymers, mastering the methods and features of calculating the strength of elements of apparatus and machines. In the course of studying the discipline, students also gain skills in using scientific, technical and reference literature, determining the technical characteristics of apparatus and equipment and evaluating their technical and economic efficiency.	6			v	v		v	
Cycle of major disciplines Selectable Component										
	Chemical technology of solid fossil fuels	The purpose of the discipline is to form students' technological thinking in the field of solid fuel	5			v	v			

		processing technology as an alternative to petroleum fuel, to provide information about the main methods and stages of fuel processing and the prospects for the development of the industry, and to teach students to creatively use general scientific and general engineering disciplines for management, understanding and explanation complex phenomena occurring in the processes of chemical processing of solid fuels								
	Thermal decomposition of coal	The purpose of studying the course "Thermal decomposition of coal" is to train highly qualified specialists, chemical engineers and technologists for the processing of solid fossil fuels, who know the methods of calculation and design of operational installations and equipment, the formation of a scientific and technical worldview among future specialists. The technology of thermal decomposition of coal for the purpose of production of various types of fuels is considered; state and prospects of the raw material base of the coke industry.	5			**v**	**v**			
	Gas chemistry	The purpose of the discipline is to form the competence of the student in the field of natural and associated gas processing technology. In the course of studying the discipline, the student must: -know the	5			**v**	**v**			

		importance of natural gases in the economy and energy, the composition of hydrocarbon gases, their physical and chemical properties, the current state and prospects for the development of the gas processing industry in Kazakhstan and the world; - be able to assess the technical and economic efficiency of technology and have the skills to determine the technical characteristics of apparatus and equipment;								
	Production of hydrocarbon raw materials for the petrochemical industry	The purpose of studying the discipline: The formation of students' systemic knowledge on the theoretical foundations and technology for the production of hydrocarbon raw materials for the petrochemical industry. In the course of studying the discipline, the student must: - know the chemistry and mechanism of thermal and catalytic transformations of oil and gas components; - to know the physical and chemical properties of hydrocarbons and other components of oil and their influence on the properties of petroleum products, - to know the principles of constructing technological schemes and designing technological processes in the petrochemical industry.	5			√	√			
	Corrosion and equipment protection	The purpose of the course is to study the fundamentals of the	6			√	√			

	of organic substances	theory of corrosion of various types of materials, methods of protecting equipment from corrosion from the standpoint of minimizing the impact on the environment, as well as the use of inhibitor protection and modern methods for studying technological processes and natural environments. Knowledge of the basics of this course will allow you to make the right choice of structural materials when creating chemical equipment in a corrosion-resistant design.								
	Preparation and use of reservoir and fresh waters for injection into the reservoir	The course presents measures to maintain reservoir pressure, which is a complex of technological equipment that is necessary for the preparation, transportation and injection of water into the oil reservoir. The student must know: the theory of oil treatment in the fields; theory of the theoretical basis of the requirements for formation waters; use of statistical methods for processing experimental data.	5			v	v			
	Technology for the production of aromatic hydrocarbons	The purpose of the discipline: The formation of students' systemic knowledge on the theoretical foundations and industrial technologies for the production of aromatic hydrocarbons from petroleum feedstocks. In the course of studying the discipline, the student must: -know the	5			v	v			

		structure, physicochemical and thermodynamic properties of aromatic hydrocarbons; - to know the industrial methods of separation and isolation of individual aromatic compounds from the concentrate of aromatic hydrocarbons; -know industrial technologies for increasing the resources of individual aromatic hydrocarbons and their isomers;								
	Modern petrochemical production	The discipline "Modern petrochemical production" is intended for professional training of specialists in the field of petrochemical production. As a result of studying the discipline, the student must: - know the chemistry and production technologies of basic petroleum products - raw materials for the production and processing of polymers (plastics, chemical fibers, films, rubbers, varnishes, coatings, etc.); - to develop an economically viable and environmentally safe technology for processing raw materials and semi-products of petrochemical synthesis; - have skills in engineering calculations.	5		v	v				
	Petroleum oils production technology	The purpose of studying the discipline "Technology for the production of petroleum oils" is to study the technological and physico-chemical foundations of the production, separation and purification of distillate and residual petroleum fractions;	5		v	v				

		parameters, hardware design and technological schemes of processes; properties and uses of petroleum oils. As a result of studying the discipline, the student must: - know the main products of petrochemical synthesis, in particular petroleum oils, their classification and specific unique properties; know the chemistry and technology of petroleum oils production; - to know about the main scientific achievements in the field of petroleum oils technology; to be able to describe the basic technological schemes of the main industries;								
	Coal hydrogenation	The purpose of studying the discipline is to study the origin, composition and properties of coal, coal hydrogenation processes, as well as the technology for obtaining motor fuels and organic substances from coal hydrogenation products. The molecular structure and petrographic composition of coals are considered, a macroscopic description of bituminous coals, microcomponents of bituminous coals, organic and inorganic components of coal are given. The influence of various factors on the process of coal hydrogenation is shown.	5			v	v			
	Organic Wastewater Treatment	To form the student's competencies in the field of theory and technology of	5		v	v				

		purification of water flows of various origins, focused on the use of modern technological solutions in the field of protection of water bodies. To instill skills in the calculation of the main processes, which will allow students to be most professionally guided in the justification of technological solutions in the implementation of integrated approaches in the development of measures for the protection of water bodies and systems for the rational water use of industrial facilities;								
	Engineering design of chemical-technological processes	The course deals with the calculation of chemical reactions occurring in reactors typical of chemical technology processes. The fundamentals of the kinetics of homogeneous and heterogeneous processes are outlined, recommendations are given for compiling the material and energy balances of reactors, and issues of their hydrodynamics are highlighted. The thermodynamics of chemical reactions, the schemes and principles of operation of absorber apparatuses, as well as the distinctive features of bubbling and spraying absorbers are considered.	5			√	√	√	√	
	International standardization and certification	When studying this discipline, the student gets acquainted with the development of certification and standardization abroad. The history of the formation of	5			√	√			

		international standardization. International Organization for Standardization - ISO. Organizational structure of ISO, STACO, PLACO, CASCO, INFCO, DECO, COPOLCO, REMCO. Certification at the international level. ISO activities in the field of certification. IEC international certification systems. Participation of international organizations in standardization work. National certification systems of France, Great Britain, USA, Japan. Certification at the regional level								
	Regulatory framework for the quality of chemical products	The main provisions for the creation of new schemes for the synthesis of large-scale production of samples of a new material using technological equipment and processes that meet all requirements with inexpensive starting materials, easy isolation of pure products and the absence of environmental problems are considered. This course is designed to introduce the basic concepts of chemical engineering for bachelors. instilling in students the ability to independently study educational literature.	5			v	v			

5. Curriculum of the educational program

MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN
KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after K.I.SATPAYEV

SATBAYEV UNIVERSITY

APPROVED
Chairman of the Management Board-
Rector of KazNRTU named after K.I.Satpayev
M.M. Begentaev
2022 y.

CURRICULUM
of Educational Program on enrollment for 2022-2023 academic year

Educational program 6B07215 - "Pharmaceutical production technology"
Group of educational programs B072 — «Pharmaceutical production technology»

Form of study: full-time | Duration of study: 4 years | Academic degree: Bachelor of Technique and Technology

Discipline code	Name of disciplines	Cycle	Total amount in credits	Total hours	Classroom amount lec/lab/pr	SIS (including TSIS) in hours	Form of control	Allocation of face-to-face training based on courses and semesters							
								I course		II course		III course		IV course	
								1 semester	2 semester	3 semester	4 semester	5semester	6 semester	7 semester	8 semester
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)															
M-1. Module of language training															
LNG 108	English language	GED, RC	10	300	0/0/6	210	E	5	5						
LNG 104	Kazakh (Russian) language	GED, RC	10	300	0/0/6	210	E	5	5						
M-2. Module of physical training															
KFK 101-104	Physical Culture	GED, RC	8	240	0/0/8	120	Difcredit	2	2	2	2				
M-3. Module of information technology															
CSE 677	Information and communication technologies (in English)	GED, RC	5	150	2/1/0	105	E			5					
M-4. Module of socio-cultural development															
HUM 100	Modern History of Kazakhstan	GED, RC	5	150	1/0/2	105	SE	5							
HUM 132	Philosophy	GED, RC	5	150	1/0/2	105	E			5					
HUM 120	Socio-political knowledge module (sociology, politology)	GED, RC	3	90	1/0/1	60	E			3					
HUM 134	Socio-political knowledge module (culturology, psychology)		5	150	2/0/1	150	E				5				
M-5. Module of anti-corruption culture, ecology and life safety base															
HUM 133	Fundamentals of anti-corruption culture	GED, CCH	5	150	2/0/1	150	E				5				
MNG 488	Fundamentals of Entrepreneurship and Leadership														
CHE 656	Ecology and life safety														
CYCLE OF BASIC DISCIPLINES (BD)															
M-6. Module of physical and mathematical training															
MAT 101	Mathematics I	BD, UC	5	150	1/0/2	105	E	5							
PHY 468	Physics	BD, UC	5	150	1/1/1	105	E	5							
MAT 102	Mathematics II	BD, UC	5	150	1/0/2	105	E		5						
M-7. Module of basic general technical training															
GEN 429	Engineering and computer graphics	BD, UC	5	150	1/0/2	105	E		5						
CHE692	Introduction to specialty	BD, UC	4	120	2/0/1	75	E	4							
CHE494	Chemistry	BD, UC	5	150	1/1/1	105	E		5						
CHE665	Organic Chemistry I	BD, UC	6	180	2/1/1	120	E			6					
CHE639	Organic Chemistry II	BD, UC	5	150	1/1/1	105	E				5				
CBI108	Analytical Chemistry	BD, UC	5	150	1/1/1	105	E			5					
CHE921	Pharmaceutical chemistry	BD, UC	5	150	2/0/1	105	E			5					
CHE869	Physical and colloidal chemistry	BD, UC	5	150	2/0/1	105	E				5				
CHE499	Biochemistry	BD, UC	5	150	2/1/0	105	E					5			
GEN411	Theoretical and applied mechanics	BD, UC	5	150	2/1/0	105	E				5				
CHE695	CAD Chemical engineering I	BD, UC	5	150	0/1/2	105	E					5			
CHE816	Main processes and apparatus of chemical engineering I	BD, UC	5	150	2/0/1	105	E					5			
3201	Elective	BD,COC	5	150	2/0/1	105	E					5			
CHE570	General chemical technology	BD, UC	5	150	2/1/0	105	E					5			
ELC570	Fundamentals of electrical engineering and electroni	BD, UC	5	150	1/2/0	105	E					5			
CHE699	CAD Chemical engineering II	BD, UC	5	150	0/1/2	105	E						5		
CHE817	Main processes and apparatus of chemical engineering II	BD, UC	4	120	2/0/1	75	E						4		
3202	Elective	BD,COC	5	150	2/0/1	105	E						5		
4201	Elective	BD,COC	6	180	2/1/1	120	E							6	
CIV784	Educational practice	BD, UC	2						2						
CYCLE OF PROFILE DISCIPLINES (PD)															
M-8. Module of professional chemical and technological activity															
CHE927	Fundamentals of pharmacognosy	PD, UC	4	120	2/0/1	75	E						4		
CHE928	Basics of designing and equipping pharmaceutical industries	PD, UC	5	150	2/0/1	105	E						5		
CHE929	Chemistry and technology of synthetic and natural medicinal substances	PD, UC	4	120	2/0/1	75	E						4		
CHE930	Industrial drug technology	PD, UC	6	180	2/0/2	120	E							6	
4301	Elective	PD,COC	5	150	2/0/1	105	E							5	
4302	Elective	PD,COC	5	150	2/0/1 1/1/1	105	E							5	
4303	Elective	PD,COC	6	180	2/0/2	120	E							6	
4304	Elective	PD,COC	5	150	2/0/1	105	E							5	

4304	Elektiv	PD, CCH	5	150	2/0/1	105	E							5	
4305	Elektiv	PD, CCH	5	150	2/0/1	105	E								5
4306	Elektiv	PD, CCH	5	150	2/0/1	105	E								5
4307	Elektiv	PD, CCH	5	150	2/0/1	105	E								5
CIV785	Production practice I	PD, UC	2								2				
CIV786	Production practice II	PD, UC	3										3		
M-9. Module of final attestation															
ECA810	Preparation and writing of a thesis (project)	FA	6												6
ECA103	Defense of the thesis (project)	FA	6												6
M-10. Module of additional types of training															
AAP910	Military affairs	ATT	0												
Total based on UNIVERSITY:								31	29	31	29	30	30	33	27
								60		60		60		60	

Number of credits for the entire period of study					
Cycle code	Cycles of disciplines	Credits			
		required component (RC)	university component (UC)	component of choice (CCH)	Total
GED	Cycle of general education disciplines	51		5	56
BD	Cycle of basic disciplines		96	16	112
PD	Cycle of profile disciplines		24	36	60
	Total for theoretical training:	*51*	*120*	*57*	*228*
FA	final attestation	12			12
	TOTAL:	63	120	57	240

Decision of the Academic Council of Kaznitu named after K.Satpayev. Protocol № 13 от "28" 04 2022.

Decision of the Educational and Methodological Council of Kaznitu named after K.Satpayev. Protocol № 4 от "26" 04 2022.

Decision of the Academic Council of the Institute_____. Protocol № 6 от "28" 02 2022

Vice-Rector for Academic Affairs — Zhautikov B.A.

Director of IGaOGB — Syzdykov A.H.

Head of the Department of Chemical and — Amitova A.A.

Council representative from employers — Kalmuratova A.A.

MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN
KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY after K. SATBAYEV

SATBAYEV UNIVERSITY

APPROVED
Director of the Institute IGaOGB
A. Syzdykov
«29» 04 2022y.

MAJOR ELECTIVE DISCIPLINES educational program for the 2022-2023 academic year admission
Educational program 6B07125 - "Chemical technology of organic substances"
Group of educational programs B060 — «Chemical engineering and processes»

Full-time study Study duration - 4 years Academic degree: bachelor of natural sciences

Year of study	Code of elective	Code of discipline	Name of discipline	Semestr	Cycle	Credits	Total hours	lec/lab/pr	SIW (including SIWT) in	Prerequisites
			M-7. Module of basic general technical training							
3	2201	CHE498	Physico-chemical methods of analysis	3	B	5	150	2/0/1	105	
		CHE472	Fundamentals of physical and chemical analysis of oil refining products and petrochemistry					2/0/1		
	2202	CHE637	Theoretical foundations of organic substances technology	4	B	5	150	2/0/1	105	
		CHE454	Fundamentals of quality control of organic compounds					2/0/1		
	4201	AUT434	Automation of control systems in chemical engineering processes	7	B	6	180	2/0/2	120	
		AUT435	Automation of control systems					2/0/2		
			M-8. Module of professional chemical and technological activity							
4	4301	CHE611	Chemical technology of solid combustible minerals	7	S	5	150	2/0/1	105	
		CHE687	Thermal decomposition of coal					2/0/1		
	4302	CHE146	Gaschemistry	7	S	5	150	2/0/1	105	
		CHE462	Production of hydrocarbon raw materials for the petrochemical industry					2/0/1		
	4303	CHE808	Economics technology of organic production	7	S	6	180	2/0/2	120	
		CHE671	Preparation and applying of reservoir and fresh water for injection into the reservoir					2/0/2		
	4304	CHE610	Technology for the production of aromatic hydrocarbons	7	S	5	150	2/0/1	105	
		CHE484	Modern petrochemistry industry					2/0/1		
	4305	CHE612	Technology for the production of petroleum oils	8	S	5	150	2/0/1	105	
		CHE686	Hydrogenation of coal					2/0/1		
	4306	CHE805	Organic Wastewater Treatment	8	S	5	150	2/0/1	105	
		CHE683	Engineering design of chemical-technological processes					2/0/1		
	4307	MSM109	International standardization and certification	8	S	5	150	2/0/1	105	
		CBI120	Normative base of chemical products quality					2/0/1		

Credits numbers of elective disciplines over the entire period of study	
Cycle of disciplines	Credits
Cycle of basic disciplines (B)	16
Cycle of special disciplines (S)	36
Overall:	52

Head of the Department of Chemical and Biochemical Engineering — Amitova A.A.

Representative of Specialty council — Kalmuratova A.A.

6. Additional educational programs (Minor)

Name of additional educational programs (Minor) with disciplines	Total number of credits	Recommended semesters of study	Documents on the results of development additional educational programs (Minor)