Geology and Oil-gas Business Institute named after K. Turyssov

Department of Chemical and Biochemical Engineering

EDUCATIONAL PROGRAM
6B07216 – Technology of polymer production and processing

the cipher and the name of the educational program

Code and classification of the field of education:

6B07 Engineering and manufacturing and construction industries

Code and classification of training areas:
6B072 Manufacturing and processing industries

Group of educational programs:
B069 Production of materials (glass, paper, plastic, wood)

Level according to the NQF: 6
Level according to the IQF: 6
Duration of study: 4 years
Volume of loans: 240

Almaty, 2022

The educational program 6B07216 – Technology of production and processing of polymers was approved at a meeting of the Scientific Council of KazNRTU named after K.I.Satpayev.

Protocol No. 13 of "_28_" _04_2022

Reviewed and recommended for approval at a meeting of the Educational and Methodological Council of KazNRTU named after K.I.Satpayev.

Protocol No. _7_ of "_26_" _04_2022

Educational program 6B07216 – Technology of production and processing of polymers the cipher and the name of the educational program
developed by the academic committee in the direction "6B072 Manufacturing and processing industries"

Full name	Academic degree/academic title.	Post	Place of work	Signature
Chairman of the Academic Committee:				
Amitova Aigul Amantayevna	Doctor of Ph.D	Head of the Department	KazNRTU	
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Employers:				
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2. The purpose and objectives of the educational program

Purpose of the educational program - Training of competitive specialists with theoretical knowledge and professional competencies capable of solving production problems, conducting design and research activities in the field of technology for the production and processing of polymers, elastomers and paints.

3. Requirements for the evaluation of learning outcomes of the educational program

4. Passport of the educational program

4.1. General information

№	Field name	Note
1	1 Code and classification of the field of education	6B07 Engineering and manufacturing and construction industries
2	Code and classification of training areas	6B072 Manufacturing and processing industries
3	Group of educational programs	B069 Production of materials (glass, paper, plastic, wood)
4	Name of the educational program	Technology of polymer production and processing
5	Brief description of the educational program	The educational program of this profile allows you to master competencies in technological and production areas, equipment, materials, methods and means of testing and quality control in the field of polymer production for various purposes, and the program is also focused on the processing of polymer products, design, commissioning, operation of technical devices.
6	The purpose of the EP	Training of competitive specialists with theoretical knowledge and professional competencies capable of solving production problems, conducting design and research activities in the field of technology for the production and processing of polymers, elastomers and paints.
7	Type of EP	New
8	Level according to the NQF	6
9	Level according to the IQF	6

10	Distinctive features of the EP	no
11	List of competencies of the educational program:	K 1.Communication skills CC 2.Basic literacy in natural sciences CC 3.General engineering competencies K 4. Professional competencies of KK 5. Engineering and computer competencies K 6.Engineering and working competencies KK7. Socio-economic competencies KK 8. Special professional competencies
12	Learning outcomes of the educational program:	1. Multilingualism, possess specialized vocabulary necessary for effective oral and written communications in a foreign language in their professional activities, the ability to participate orally or in writing in professional discussions; 2. To know the basic laws of natural science disciplines and methods of mathematical analysis and modeling in solving problems in the field of polymer production and processing technology and industry, the ability to find solutions to general technical problems; 3. Apply knowledge of current trends in the development of the industry in production and technological, design, research and organizational and managerial activities; 4. Have a wide range of theoretical and practical knowledge in the professional field, carry out technological processes of various levels of complexity, operation of equipment and ensuring their safe functioning; 5. Formation of the ability to independently and in practice apply new knowledge and skills with the help of information technology, including in new areas of knowledge not directly related to the field of activity, to process information using modern programs and databases for calculating technological parameters of tools used in the use of modern information technologies, obtaining polymers and monitoring the natural environment Wednesday; 6. To solve various typical practical tasks that require an independent analysis of work situations: to conduct the main technological process in the field of their professional activities, of various levels of complexity; 7. To understand the impact of engineering solutions in the global, economic, natural and social context; to know the trends of social development of society, to be able to adequately navigate in various social situations. 8. To choose and justify a rational technological scheme for the production of polymers, elastomers, paints and varnishes, taking into account economic and environmental factors.
13	Form of training	Daytime
14	Duration of training	4 years
15	Volume of loans	240
16	Languages of instruction	Kazakh, Russian, English
17	Academic degree awarded	Bachelor of Engineering and Technology in Engineering and Engineering
18	Developer(s) and authors:	1. Head of the department Amitova A.A. 2. Director of the Institute Syzdykov A.H. 3. Assoc-Professor, Ph.D., Chugunova N.I. 4. Assistant professor, Ph.D., Kerimkulova A.Zh.

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

№	Name of the discipline	Brief description of the discipline	Number of credits	Generated learning outcomes (codes)							
				PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
Cycle of general education disciplines Required 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. During the transition from level to level, the prerequisites and post-prerequisites of discipline are observed.	**10**	**v**							
	Kazakh (Russian) language	The socio-political, socio-cultural spheres of communication and functional styles of the modern Kazakh (Russian) language are considered. The course highlights the specifics of scientific style in order to develop and activate professional and communicative skills and abilities of students, allows students to practically master the basics of scientific style and develops the ability to perform structural and semantic analysis of the text.	**10**	**v**							

	Information and communication technologies (in English)	Required component. The task of studying the discipline is to acquire theoretical knowledge about information processes, about new information technologies, local and global computer networks, methods of information protection; to acquire skills in using text editors and tabular processors; to create databases and various categories of application programs.	**5**					**v**			
	Modern history of Kazakhstan	The course studies historical events, phenomena, facts, processes that took place on the territory of Kazakhstan from ancient times to the present day. The sections of the discipline include: the steppe empire of the Turks; early feudal states on the territory of Kazakhstan; Kazakhstan during the Mongol conquest (XIII century), medieval states in the XIV-XV centuries. The epoch of the Kazakh Khanate XV-XVIII centuries. Kazakhstan as part of the Russian Empire, Kazakhstan during the Great Patriotic War, during the formation of independence and at the present stage.	**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 existence and gives them a methodology for solving various theoretical and practical	**5**							**v**	

		issues. Philosophy expands the horizon of vision of the modern world, forms citizenship and patriotism, promotes self-esteem, awareness of the value of human existence. It teaches how to think and act correctly, develops practical and cognitive skills, helps to search and find ways and means of living in harmony with oneself, society, and the world around us.									
	Module of socio-political knowledge (sociology, political science)	The study of the course contributes to the formation of students' theoretical knowledge about society as an integral system, provides the political aspect of 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 to understand political processes, to form a political culture, to develop a personal position and a clearer understanding of the measure of one's responsibility.	**3**	**v**							
	Module of socio-political knowledge (cultural studies, psychology)	The module of socio-political knowledge (cultural studies, psychology) is designed to familiarize students with the cultural achievements of mankind, to understand and assimilate the basic forms and universal patterns of formation and development of culture.	**3**		**v**						

		During the course of cultural studies, general problems of the theory of culture, leading cultural concepts, universal patterns and mechanisms of formation and development of culture, the main historical stages of the formation and development of Kazakh culture are considered. The regularities of the emergence, development and functioning of mental processes, states, properties of a person engaged in a particular activity, the regularities of the development and functioning of the psyche as a special form of vital activity are also studied.									
Cycle of general education disciplines University component											
	Fundamentals of anti-corruption culture	The discipline studies the essence, causes, causes of sustainable development of corruption from both historical and modern points of view. Examines the prerequisites and impact for the development of an anti-corruption culture. Studies the development of anti-corruption on the basis of social, economic, legal, cultural, moral and ethical norms. Studies the problems of the formation of an anti-corruption culture based on the relationship with various types of social relations and various manifestations. Situations of conflict of interests and moral choice are analyzed; improving the anti-corruption	**5**		**v**			**v**		**v**	

		culture; actions in a conflict of interest situation.anti-corruption culture based on the relationship with various types of public relations and various manifestations. Situations of conflict of interests and moral choice are analyzed; improvement of anti-corruption culture; actions in a situation of conflict of interests.									
	Fundamentals of Entrepreneurship and Leadership	Fundamentals of Entrepreneurship and Leadership The discipline studies the basics of entrepreneurship and leadership from the point of view of science and law; features, problematic aspects and prospects of development; theory and practice of entrepreneurship as a system of economic, organizational and legal relations of business structures; readiness of entrepreneurs for innovative receptivity. The discipline reveals the content of entrepreneurial activity, career stages, qualities, competencies and responsibilities of an entrepreneur, theoretical and practical business planning and economic expertise of business ideas, as well as risk analysis of innovative development, introduction of new technologies and technological solutions..	**5**			**v**	**v**				
	Ecology and life safety	Ecology and life safety The discipline studies the tasks of	**5**			**v**	**v**			**v**	

		ecology as a science, environmental terms, laws of functioning of natural systems and aspects of environmental safety in working conditions. Environmental monitoring and management in the field of its safety. Sources of pollution of atmospheric air, surface, groundwater, soil and ways to solve environmental problems; life safety in the technosphere; natural and man-made emergencies									
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 and solve the simplest geometric, physical and other applied problems. The main focus is on differential and integral calculus. The course program includes differential calculus of functions of one variable, derivative 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.	**5**		**v**	**v**	**v**				
	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	**5**		**v**						

		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 course 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.									
	Mathematics II	The discipline is a continuation of Mathematics 1. The course sections include elements of linear algebra and analytical geometry. The main issues 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. The elements of analytical geometry on the plane and in space are included..	**5**		**v**	**v**	**v**		**v**		
Cycle of basic disciplines Component of choice											
	Engineering and computer graphics	The discipline is aimed at studying methods of object image and general rules of drawing, using computer graphics; studying the basic	5			**v**	**v**	**v**			

		principles and geometric modeling approach and methodology for developing applications with a graphical interface; developing skills in the use of graphic systems for the development of drawings, using 2D and 3D modeling methods									
	Introduction to the specialty	The purpose of the discipline is to acquaint students who have started studying at the university with the basic and basic provisions of the specialty and the training program; the development of interest in the chosen profession, the formation of students' competence and understanding of the chosen field of study, initial professional knowledge about the physico-chemical fundamentals of organic matter technology; the formation of technological and environmental thinking among students. The basic initial concepts of chemical technology are considered: kinetic patterns of chemical transformations, types of reactors and equations of molar balances, technological indicators of processes, preparation of technological schemes of chemical processes.	4			v	v				
	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 course is	5		v	v					

		aimed at instilling the skills of conducting chemical experiments. The course covers the nomenclature of chemical compounds, basic chemical laws and concepts, methods for studying the physico-chemical properties of substances and the main classes of inorganic compounds, as well as their application in solving professional problems. Upon completion of the course, the student must be able to apply the acquired knowledge, skills, skills and competencies in the study of general scientific and special disciplines related to chemical disciplines, as well as apply the acquired knowledge, skills, skills and competencies in solving production and technological problems.									
	Organic Chemistry I	The purpose of the discipline is to master the complex of knowledge and scientific ideas about the fundamental theoretical and experimental foundations of organic chemistry of aliphatic compounds; in obtaining students' knowledge of the basic concepts of theoretical organic chemistry, mastering the skills to characterize the structure, physico-chemical properties of organic substances, as well as modern methods of synthesis of organic substances. The course forms the basis of chemical reactions and methods of	6			v	v		v		

		synthesis of organic compounds for the most important branches of the chemical and biochemical industry									
	Organic Chemistry II	Study of general patterns 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 acquired basic scientific and theoretical knowledge to solve scientific and practical problems.	5			v	v		v		
	Physical and colloidal chemistry	The purpose of the course: the formation of students' scientific thinking, in particular, the correct understanding of the limits of applicability of various physico-chemical concepts, laws, theories. The course covers chemical thermodynamics, the first beginning of thermodynamics, thermal effects, Hess's Law, Kirchhoff equations, the second beginning of thermodynamics. Entropy. Chemical equilibrium. The doctrine of solutions. Phase equilibria. Electrochemistry. Solutions of electrolytes.	5			v	v		v		

		Galvanic cells. Chemical kinetics and catalysis. Surface phenomena. Dispersed systems. Methods of preparation and purification.									
	Fundamentals of analytical chemistry of organic substances	The purpose of mastering the discipline is to master the theoretical foundations of modern chemical analysis of organic compounds. Summary: Fundamentals of qualitative and quantitative analysis of chemical compounds. Theory of gravimetric, titrimetric analysis. The method of analysis of organic compounds. Analysis of complex organic compounds.Distinguishing features of the analysis of organic compounds from the analysis of inorganic compounds. Qualitative elemental analysis. Determination of carbon, hydrogen and nitrogen. Quantitative elemental analysis. Semi-microanalysis. Microanalysis. Macro methods of organic elemental analysis. Determination of carbon and hydrogen.	5			v	v		v		
	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 to determine the elements of organogens, halogens and some heteroelements and organic compounds in other various	5			v	v		v		

		objects. The purpose of this course is: formation of students' active position and development of initiative in solving various problems arising in the process of analysis, development of the ability to present chemical analysis from sample selection to the final result as a single technological process using modern methodology.									
	Fundamentals of chemistry and technology of monomers	The course is designed to study the method of obtaining and basic technological schemes for the synthesis of specific monomers, for the production of polyolefins as lower olefins (ethylene, propylene, isobutylene), halogen-containing monomers, styrene, acrylic monomers, esters and esters used for the further synthesis of various polymers and polymer materials based on them. An example of large-capacity production of expanded polystyrene is given. The issues of synthesis and production of polycondensation monomers for the production of esters, polyamides, phenol-, carbamide- and melamine-formaldehyde polymers, polyurethanes, polycabonates are disclosed.	5		v	v	v		v		v
	Theoretical foundations of organic substances technology	The purpose of the discipline is for students to study modern trends in the creation of theoretical foundations of technology for processing oil, gas, coal, hydrocarbon raw	5		v	v	v		v		

		materials, monomers for the synthesis of polymers and synthetic rubbers, synthetic detergents. The theoretical foundations of preparation and physical methods of separation of oil, gas, coal and products of their processing, various processes (thermodestructive, thermooxidative, catalytic) transformations of combustible minerals and products of their processing are considered, the theoretical foundations of polymer production, which are one of the main directions of application of organic substances, are touched upon.									
	General chemical technology	The purpose of the course: to study the general patterns of chemical and technological processes (CTP) of the most important chemical industries. The course examines the patterns of chemical transformations in industrial production conditions; 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 of development of effective chemical-technological processes and systems, methods of energy and resource conservation, environmental protection.			v	v		v			
	CAD Chemical	The purpose of studying the	5			v	v	v	v		

	engineering I	discipline is to consider the basic concepts of computer graphics, the theoretical foundations of the description of geometric objects and their representation in a computer. The issues studied are theoretical and practical foundations for the creation of engineering technical documentation, the creation of graphical computer applications for image processing in the field of chemical technology of organic substances. Theoretical foundations of constructing images of points, lines, planes and certain types of lines and surfaces with the conventions of the ESCD standards; fundamentals of drawing by means of computer graphics using the AutoCAD graphics package.									
	Basic processes and devices of chemical technology I	Study of regularities and mathematical description 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. Classification of the main processes and devices of chemical technology. The method of calculating the devices. Equations of equilibrium of an ideal fluid. Equations of motion of ideal	5			v	v	v	v		

		liquids. Separation of heterogeneous systems. The main regularities of the flow of hydromechanical and heat exchange processes, designs and principles of operation of devices used in these processes.									
Cycle of profile disciplines University component											
	Polymer production technology	The study of the course begins with familiarization with the concept of polymers and polymeric materials. Technological methods of carrying out polymerization processes of polymer synthesis are revealed. Students get acquainted with the principles of creating polymer composite materials. Then they study the production of specific polymerization monomers - unsaturated aliphatic hydrocarbons, their halogen derivatives and aromatic monomers. The characteristic of polyacrylate production is given. Plastic masses based on polymers obtained by polycondensation reaction are considered. Polymers based on phenol and aldehydes. Production of polyesters. Properties and application of polyesters. Polyethylene terephthalate. Polycarbonates.	5			**v**	**v**		**v**		
	Chemistry and physics of polymers	The purpose of the discipline is to study by students the main directions of modern development of chemistry and physics of polymers, their use	5		**v**	**v**	**v**				**v**

		and various sectors of the economy. General concepts and terminology in the field of polymers. Regularities of the chain and step mechanism of polymer synthesis. Chemical modification of polymers. Molecular and supramolecular structure of polymers. Deformation properties of polymers. Thermomechanical method of polymer research. Features of polymer dissolution. In the process of mastering this discipline, students develop knowledge on the classification and terminology of polymers.									
	Chemistry of hydrocarbons	The purpose of studying the discipline is to form and deepen knowledge in the field of hydrocarbon chemistry. Summary: The role of hydrocarbon raw materials in the economy of the Republic of Kazakhstan. Oil and natural gas. Chemical composition of oil and gas. Hydrocarbons of oil and petroleum products, gas sources. Paraffin hydrocarbons (alkanes).Naphthenic hydrocarbons (cycloalkanes) of oil. Isolation of individual substances and purification of hydrocarbon compounds; Unsaturated hydrocarbons, basic properties. Alkenes and alkynes are sources of monomer synthesis.Aromatic hydrocarbons.				v	v		v		
	Technology of	Structure of surfactants,	5			v	v				v

	production of surfactants	classification of surfactants (nonionic and anionic), production of surfactants from higher fatty alcohols, the effect of surfactants on environmental components, applications, methods of determination (surface tension method, method of determining the edge angle (wetting angle) with a solid or liquid surface) the method of rotating droplet.									
	CAD Chemical Engineering II	The purpose of the discipline is to study the modeling of chemical and technological processes using the AspenHysys modeling software package. The course studies the basic concepts of the modeling method, methods of constructing a technological scheme, characteristics of the technological scheme and flows, calculation of parameters of all flows and equipment. The course forms the ability to develop an optimal chemical process technology with a high-quality output of the target product.	5			v	v	v			
	The main processes and apparatuses of chemical technology II	The purpose of studying the discipline: is to study the patterns and mathematical description of mass transfer processes occurring in systems with the presence of several phases and several components and the formation of knowledge and skills in the field of processes and apparatuses of chemical technology and	4			v	v	v			

		practical calculations of processes and apparatuses. Mass transfer processes, calculation and selection of devices and structures; comparative analysis of the operation of devices, finding optimal conditions for technological processes.									
	Technology of organic and petrochemical industries	To form a set of knowledge among students about the methods of conducting production processes, scientific thinking about understanding the logical connection between the chemical structure and the 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		v		
	Automation of control systems in chemical and 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. Possession of sections of containers necessary for solving research and applied tasks. The course "ASUHTP" provides a presentation of the sections of the basics of TAR, measuring elements, functional circuits. 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	6			v	v	v			

		law of regulation, to develop a functional and mathematical model of the control system, to analyze the operation of the system based on qualitative indicators of regulation.									
	Ecology and environmental protection of polymer enterprises	The purpose of mastering the discipline is to prepare students to solve the most important tasks of rational nature management, environmental protection and human health. Summary: The importance of environmental education for the future specialist in the production and processing of polymers. Special and extreme types of pollution that occur in the production of products made of polymer materials. Scientific and practical achievements in the field of industrial ecology, engineering environmental protection. Methods of development of new, more effective processes of neutralization, use of waste from polymer production.	6			v	v	v			v
Cycle of profile disciplines University component											
	Polymer processing technology	The purpose of the discipline is for students to study the basic principles of polymer synthesis and their physical and mechanical properties. Free radical polymerization. Stepwise processes of polymer synthesis. Chemical reactions of polymers. Oxidation and aging of polymers. Structure and physical states of polymers. The concept	4			v	v		v		

		of polydispersity and molecular mass distribution; mechanical properties of crystalline and glassy polymers; the strength of polymers. Classify and construct possible structures of polymers obtained by free radical polymerization and polycondensation; possess the features of the behavior of macromolecules and their supramolecular structures; link the physical characteristics of polymers with their structure and structure.									
	Fundamentals of enterprise design	The purpose of the discipline is to study the structures, the principle of operation of basic and special equipment for chemical production, familiarization with its main components and details. At the end of the course, the student must know the basic principles of design and development of a feasibility study of production; parameters and modes of operation of standard equipment; typical processes of chemical technology, corresponding devices and methods of their calculation; requirements for the technical condition of equipment; methods of technological calculations of individual components and parts of chemical equipment.	5				v	v	v		
	Polycondensation materials	The purpose of the discipline is for students to study the basic	4			v	v		v		

		provisions of polymer synthesis by polycondensation Summary: Methods of obtaining synthetic polymers. Structure and classification of polycondensation polymers. The main types of polycondensation reactions, their conditions and mechanism. Monomers for polycondensation resins. Functionality of monomers. Cyclization as a competing reaction. Kinetics and MMR in polycondensation. Patterns of reversible and irreversible polycondensation. Methods of polycondensation. PC regularities in the melt, in solution, technological features. Emulsion polycondensation. Interphase polycondensation and its varieties.									
	Fundamentals of industrial construction	The purpose of studying the discipline: mastering the basics of construction, analysis and design of the petrochemical industry. the main stages and design of petrochemical productions are considered. The main stages of designing enterprises of the petrochemical industry. Introduction to construction design. Selection and development of the technological scheme of the industry. The choice of technological construction of petrochemical plants. After mastering this discipline, the student must: know: the basics of the industry of the	6			v	v		v		

		petrochemical industry based on the production method, the main types of construction and its technological calculation;;									
Cycle of profile disciplines Component of choice											
	Secondary polymer processes	Familiarization of students with the basics of secondary polymer processes. Recycling of secondary polymers. Problems of waste disposal. The composition of household waste. Methods of waste disposal. Disposal of polymer waste. Sources of polymer waste. Isolation of polymers from household waste. Methods of disposal of polymer waste. Features of secondary polymers. Recycling of secondary polymers into products. The use of recycled polymers. Chemical processing of polymer waste.	5			**v**	**v**				**v**
	Recycling of polymer materials	The purpose of mastering the discipline is to form knowledge about the importance of waste recycling for solving environmental problems of polymer waste recycling plants. Summary: Analysis of the state of recycling of polymer materials, waste classification, waste recycling system in the world, features of recycling of polymer waste. The main methods of recycling polymer production waste. Methods of processing waste products for the production and processing of thermoplastic materials.				**v**	**v**				**v**

	Chemistry and technology of paints and coatings	The purpose of teaching the discipline is to form students' basic theoretical knowledge and practical skills in chemistry and technology of film–forming polymers and coatings. Summary: Classification of paint and varnish materials. Theoretical regularities and physico-chemical foundations of the development of paint and varnish materials (LCM) and coatings. Synthetic film-forming substances. Technology of production and properties of coatings based on various synthetic polymers, petroleum polymer resins. Film-forming substances based on natural compounds.				v	v				v
	Fundamentals of ionite production and application	Mastering the basics of the theory of ionites, analysis in the study by students of the basic provisions of the synthesis of ionites and their physical and mechanical properties. Chemical and technological issues of ion exchange sorption and desorption of ionites are considered. The main stages of obtaining complex ion-exchange electroneutral substances, highly concentrated electrolyte solutions. Fundamentals of the production and application of ionites, the main types of construction and its technological calculation; Be able to: build a kinetic model of the process and a technological	5			v	v				v

		scheme for the production and use of ionites based on the knowledge and information obtained from technical literature, including original sources									
	Economic aspects of organic matter technology	The purpose of the discipline is to form a set of knowledge among students 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.	6			v	v				v
	Principles of chemical engineering	Familiarization of students with the basics of physico-chemical processes of chemical technology and familiarization with the principles of the device and calculation methods of devices designed to carry out these processes. The main processes of chemical technology. The absorption process. Hydrodynamic modes of packing columns. Formation of highly qualified specialists with general scientific and professional training, capable of independent creative work, to	5			v	v				

		introduce the latest and progressive results into the production process and having an integrated knowledge system.									
	Physico-chemical methods of analysis	The course is designed to understand the principles of research and experimental work on modern analytical tools and practical use of the results and the data obtained. The purpose of the course is to teach students how to use FHMA to study the properties and composition of new organic materials and substances.Theoretical principles of methods, methods of computer processing of experimental results are described. Mass spectrometric methods. Electronic paramagnetic resonance (EPR) method. Nuclear magnetic resonance (NMR) method. Radiometric methods.	5			v	v		v		
	Technical analysis of polymers and polymer products	The purpose of the discipline is to form the theoretical and practical basis necessary for a chemical technologist in terms of conducting input, technical control of polymers and polymer products. Summary: The theoretical foundations of analytical control of production are considered; General information about metrology, standardization in the system of technical control in chemical industry enterprises.Physical quantities as a measurement object. Methods for determining the physical parameters of	5			v	v		v		

		polymers. General methods of analytical control; the main elements and objects of environmental control of production; chemical, physical and physico-chemical methods of analysis.									
	Quality control of polymer materials production	The main provisions for the creation of high-quality polymer materials for large-scale production of samples of new material using technological equipment and processes that meet all requirements with inexpensive raw materials, easy separation of clean products and the absence of environmental problems. This course is designed to familiarize with the basic concepts of chemical engineering for bachelors, the theory of quality control of polymer materials production; the theory of the theoretical basis of new standards; apply the acquired skills to solve questions on new materials.	5			v	v		v		
	Physical and mechanical testing of plastics	The purpose of studying the discipline is to instill in students the skills of conducting physical and mechanical testing of plastics. Summary: Examines the physical and mechanical properties of plastics, standardization and certification of plastic testing methods, standard test methods, the relationship of loading conditions of polymers	5			v	v		v		

		and products made of them with their mechanical behavior and mechanical properties. Methods of testing polymer materials. Mechanical tests. Strength, deformation and tensile modulus of elasticity.									
	Nanocomposites and nanomaterials	The course is designed to provide training for students (bachelors in the discipline "Nanocomposites and nanomaterials") in accordance with the requirements in the areas of polymer production and processing technology. The purpose of studying the discipline "Nanocomposites and nanomaterials" is to study the main classes of nanomaterials and nanotechnologies used in the manufacture of photonics and optoinformatics devices and the development of disciplinary competencies.	5		v	v					v
	Fundamentals of obtaining composite materials	The purpose of the study is to give an in-depth understanding of the principles of creating polymer composite materials (PCM) with an improved complex of physico-chemical properties. Formation of students' ability to understand the physico-chemical essence of the processes of obtaining PCM and use the basic theoretical patterns in complex production and technological activities. Classification of composite materials according to materials science, structural, technological and operational principles.	5			v	v				v

		Mastering this course allows you to expand your understanding of the principles of creating composite materials based on thermo- and reactoplasts, the theoretical foundations for choosing plastics to create products for a specific process of study to give an in-depth understanding of the principles of creating polymer composite materials (PCM) with an improved complex of physicochemical properties. Formation of students' ability to understand the physico-chemical essence of the processes of obtaining PCM and use the basic theoretical patterns in complex production and technological activities. Classification of composite materials according to materials science, structural, technological and operational principles. Mastering this course allows you to expand your understanding of the principles of creating composite materials based on thermo- and reactoplasts, the theoretical foundations for choosing plastics to create products for a specific purpose									
	Equipment of polymer production and processing enterprises	The purpose of studying the discipline is: students receive professional training in the design of polymer production and processing enterprises, study of standard equipment used for the production of polymers and their processing into products,	5			v	v				

		substantiation of methods of production of plastic products, consumer goods. Study of the composition of the project (working draft), design and estimate documentation, the grounds for its development, the organizational foundations of the design of organic synthesis enterprises, the study of structures, the principle of operation of basic and special equipment for the production and processing of organic substances, familiarization with its main components and details, the development of methods and features of calculating the strength of elements of apparatuses and machines.Requirements for the design of chemical equipment..									
	Fundamentals of design and equipment of organic synthesis enterprises	Study of the composition of the project (working draft), design and estimate documentation, the grounds for its development, the organizational foundations of the design of organic synthesis enterprises, the study of structures, the principle of operation of basic and special equipment for the production and processing of organic substances, familiarization with its main components and details, the development of methods and features of calculating the strength of elements of apparatuses and machines.	5			v	v				

		Classification of equipment. Materials used for the manufacture of equipment. Design, technical projects, technological, mechanical calculations. Calculation of elements of devices.									

4.4. Information about disciplines

№	Name of the discipline	Brief description of the discipline (30-50 words)	Number of credits	Formed competencies (codes)
The cycle of general education disciplines is a mandatory 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. During the transition from level to level, the prerequisites and post-prerequisites of discipline are observed.	10	**КК1**
	Kazakh (Russian) language	The socio-political, socio-cultural spheres of communication and functional styles of the modern Kazakh (Russian) language are considered. The course highlights the specifics of scientific style in order to develop and activate professional and communicative skills and abilities of students, allows students to practically master the basics of scientific style and develops the ability to perform structural and semantic analysis of the text.	10	**КК1**
	Information and communication technologies (in English)	Required component. The task of studying the discipline is to acquire theoretical knowledge about information processes, about new information technologies, local and global computer networks, methods of information protection; to acquire skills in using text editors and tabular processors; to create databases and various categories of application programs.	5	**КК5**
	Modern history of Kazakhstan	The course studies historical events, phenomena, facts, processes that took place on the territory of Kazakhstan from ancient times to the present day. The sections of the discipline include: the steppe empire of the Turks; early feudal states on the territory of Kazakhstan; Kazakhstan during the Mongol conquest (XIII century), medieval states in the XIV-XV centuries. The epoch of the Kazakh Khanate XV-XVIII centuries. Kazakhstan as part of the Russian Empire, Kazakhstan during the Great Patriotic War, during the formation of independence and at the present stage.	5	**КК7**
	Philosophy	Philosophy forms and develops critical and creative thinking, worldview and culture, provides knowledge about the most general and fundamental problems of existence and gives them a methodology for solving various theoretical and practical issues. Philosophy expands the horizon of vision of the modern world, forms citizenship and patriotism, promotes self-esteem, awareness of the value of human existence. It teaches	5	**КК7**

		how to think and act correctly, develops practical and cognitive skills, helps to search and find ways and means of living in harmony with oneself, society, and the world around us.		
	Module of socio-political knowledge (sociology, political science)	The study of the course contributes to the formation of students' theoretical knowledge about society as an integral system, provides the political aspect of 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 to understand political processes, to form a political culture, to develop a personal position and a clearer understanding of the measure of one's responsibility.	3	**КК7**
	Module of socio-political knowledge (cultural studies, psychology)	The module of socio-political knowledge (cultural studies, psychology) is designed to familiarize students with the cultural achievements of mankind, to understand and assimilate the basic forms and universal patterns of 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 of formation and development of culture, the main historical stages of the formation and development of Kazakh culture are considered. The regularities of the emergence, development and functioning of mental processes, states, properties of a person engaged in a particular activity, the regularities of the development and functioning of the psyche as a special form of vital activity are also studied.	3	**КК7**
	Fundamentals of anti-corruption culture	The discipline studies the essence, causes, causes of sustainable development of corruption from both historical and modern points of view. Examines the prerequisites and impact for the development of an anti-corruption culture. Studies the development of anti-corruption on the basis of social, economic, legal, cultural, moral and ethical norms. Studies the problems of the formation of an anti-corruption culture based on the relationship with various types of social relations and various manifestations. Situations of conflict of interests and moral choice are analyzed; improving the anti-corruption culture; actions in a conflict of interest situation.anti-corruption culture based on the relationship with various types of public relations and various manifestations. Situations of conflict of interests and moral choice are analyzed; improvement of anti-corruption culture; actions in a situation of conflict of interests.	5	**КК6**

	Fundamentals of Entrepreneurship and Leadership	Fundamentals of Entrepreneurship and Leadership The discipline studies the basics of entrepreneurship and leadership from the point of view of science and law; features, problematic aspects and prospects of development; theory and practice of entrepreneurship as a system of economic, organizational and legal relations of business structures; readiness of entrepreneurs for innovative receptivity. The discipline reveals the content of entrepreneurial activity, career stages, qualities, competencies and responsibilities of an entrepreneur, theoretical and practical business planning and economic expertise of business ideas, as well as risk analysis of innovative development, introduction of new technologies and technological solutions..	5	**КК6**
	Ecology and life safety	Ecology and life safety The discipline studies the tasks of ecology as a science, environmental terms, laws of functioning of natural systems and aspects of environmental safety in working conditions. Environmental monitoring and management in the field of its safety. Sources of pollution of atmospheric air, surface, groundwater, soil and ways to solve environmental problems; life safety in the technosphere; natural and man-made emergencies	5	**КК4, КК7**
		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 and solve the simplest geometric, physical and other applied problems. The main focus is on differential and integral calculus. The course program includes differential calculus of functions of one variable, derivative 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.	5	**КК 2, КК5**
	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 course 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	**КК 2, КК3**
	Mathematics II	The discipline is a continuation of	5	**КК 2, КК3**

		Mathematics 1. The course sections include elements of linear algebra and analytical geometry. The main issues 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. The elements of analytical geometry on the plane and in space are included..		
Cycle of basic disciplines Component of choice				
	Engineering and computer graphics	The discipline is aimed at studying methods of object image and general rules of drawing, using computer graphics; studying the basic principles and geometric modeling approach and methodology for developing applications with a graphical interface; developing skills in the use of graphic systems for the development of drawings, using 2D and 3D modeling methods	5	**КК 2, КК3**
	Introduction to the specialty	The purpose of the discipline is to acquaint students who have started studying at the university with the basic and basic provisions of the specialty and the training program; the development of interest in the chosen profession, the formation of students' competence and understanding of the chosen field of study, initial professional knowledge about the physico-chemical fundamentals of organic matter technology; the formation of technological and environmental thinking among students. The basic initial concepts of chemical technology are considered: kinetic patterns of chemical transformations, types of reactors and equations of molar balances, technological indicators of processes, preparation of technological schemes of chemical processes.	4	**КК4**
	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 course is aimed at instilling the skills of conducting chemical experiments. The course covers the nomenclature of chemical compounds, basic chemical laws and concepts, methods for studying the physico-chemical properties of substances and the main classes of inorganic compounds, as well as their application in solving professional problems. Upon completion of the course, the student must be able to apply the acquired knowledge, skills, skills and competencies in the study of general scientific and special disciplines related to chemical disciplines, as well as apply the acquired knowledge, skills, skills and competencies in solving production and technological problems.	5	**КК 2**

	Organic Chemistry I	The purpose of the discipline is to master the complex of knowledge and scientific ideas about the fundamental theoretical and experimental foundations of organic chemistry of aliphatic compounds; in obtaining students' knowledge of the basic concepts of theoretical organic chemistry, mastering the skills to characterize the structure, physico-chemical properties of organic substances, as well as modern methods of synthesis of organic substances. The course forms the basis of chemical reactions and methods of synthesis of organic compounds for the most important branches of the chemical and biochemical industry	6	**КК 2, КК4**
	Organic Chemistry II	Study of general patterns 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 acquired basic scientific and theoretical knowledge to solve scientific and practical problems.	5	**КК 2 , КК4**
	Physical and colloidal chemistry	The purpose of the course: the formation of students' scientific thinking, in particular, the correct understanding of the limits of applicability of various physico-chemical concepts, laws, theories. The course covers chemical thermodynamics, the first beginning of thermodynamics, thermal effects, Hess's Law, Kirchhoff equations, the second beginning of thermodynamics. Entropy. Chemical equilibrium. The doctrine of solutions. Phase equilibria. Electrochemistry. Solutions of electrolytes. Galvanic cells. Chemical kinetics and catalysis. Surface phenomena. Dispersed systems. Methods of preparation and purification.	5	**КК 2, КК3, КК4**

	Fundamentals of analytical chemistry of organic substances	The purpose of mastering the discipline is to master the theoretical foundations of modern chemical analysis of organic compounds. Summary: Fundamentals of qualitative and quantitative analysis of chemical compounds. Theory of gravimetric, titrimetric analysis. The method of analysis of organic compounds. Analysis of complex organic compounds.Distinguishing features of the analysis of organic compounds from the analysis of inorganic compounds. Qualitative elemental analysis. Determination of carbon, hydrogen and nitrogen. Quantitative elemental analysis. Semi-microanalysis. Microanalysis. Macro methods of organic elemental analysis. Determination of carbon and hydrogen.	5	**КК4**
	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 to determine the elements of organogens, halogens and some heteroelements and organic compounds in other various objects. The purpose of this course is: formation of students' active position and development of initiative in solving various problems arising in the process of analysis, development of the ability to present chemical analysis from sample selection to the final result as a single technological process using modern methodology.	5	**КК4**
	Fundamentals of chemistry and technology of monomers	The course is designed to study the method of obtaining and basic technological schemes for the synthesis of specific monomers, for the production of polyolefins as lower olefins (ethylene, propylene, isobutylene), halogen-containing monomers, styrene, acrylic monomers, esters and esters used for the further synthesis of various polymers and polymer materials based on them. An example of large-capacity production of expanded polystyrene is given. The issues of synthesis and production of	5	**КК3, КК4**

		polycondensation monomers for the production of esters, polyamides, phenol-, carbamide- and melamine-formaldehyde polymers, polyurethanes, polycabonates are disclosed.		
	Theoretical foundations of organic substances technology	The purpose of the discipline is for students to study modern trends in the creation of theoretical foundations of technology for processing oil, gas, coal, hydrocarbon raw materials, monomers for the synthesis of polymers and synthetic rubbers, synthetic detergents. The theoretical foundations of preparation and physical methods of separation of oil, gas, coal and products of their processing, various processes (thermodestructive, thermooxidative, catalytic) transformations of combustible minerals and products of their processing are considered, the theoretical foundations of polymer production, which are one of the main directions of application of organic substances, are touched upon.	5	**КК3, КК4**
	General chemical technology	The purpose of the course: to study the general patterns of chemical and technological processes (CTP) of the most important chemical industries. The course examines the patterns of chemical transformations in industrial production conditions; 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 of development of effective chemical-technological processes and systems, methods of energy and resource conservation, environmental protection.		
	CAD Chemical engineering I	The purpose of studying the discipline is to consider the basic concepts of computer graphics, the theoretical foundations of the description of geometric objects and their representation in a computer. The issues studied are theoretical and practical foundations for the creation of engineering technical documentation, the creation of	5	**КК3, КК4**

		graphical computer applications for image processing in the field of chemical technology of organic substances. Theoretical foundations of constructing images of points, lines, planes and certain types of lines and surfaces with the conventions of the ESCD standards; fundamentals of drawing by means of computer graphics using the AutoCAD graphics package.		
	Basic processes and devices of chemical technology I	Study of regularities and mathematical description 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. Classification of the main processes and devices of chemical technology. The method of calculating the devices. Equations of equilibrium of an ideal fluid. Equations of motion of ideal liquids. Separation of heterogeneous systems. The main regularities of the flow of hydromechanical and heat exchange processes, designs and principles of operation of devices used in these processes.	5	**КК3, КК4, КК5**
	Polymer production technology	The study of the course begins with familiarization with the concept of polymers and polymeric materials. Technological methods of carrying out polymerization processes of polymer synthesis are revealed. Students get acquainted with the principles of creating polymer composite materials. Then they study the production of specific polymerization monomers - unsaturated aliphatic hydrocarbons, their halogen derivatives and aromatic monomers. The characteristic of polyacrylate production is given. Plastic masses based on polymers obtained by polycondensation reaction are considered. Polymers based on phenol and aldehydes. Production of polyesters. Properties and application of polyesters. Polyethylene terephthalate. Polycarbonates.	5	**КК3, КК4**
	Chemistry and physics of	The purpose of the discipline is	5	**КК3, КК4**

	polymers	to study by students the main directions of modern development of chemistry and physics of polymers, their use and various sectors of the economy. General concepts and terminology in the field of polymers. Regularities of the chain and step mechanism of polymer synthesis. Chemical modification of polymers. Molecular and supramolecular structure of polymers. Deformation properties of polymers. Thermomechanical method of polymer research. Features of polymer dissolution. In the process of mastering this discipline, students develop knowledge on the classification and terminology of polymers.			
	Chemistry of hydrocarbons	The purpose of studying the discipline is to form and deepen knowledge in the field of hydrocarbon chemistry. Summary: The role of hydrocarbon raw materials in the economy of the Republic of Kazakhstan. Oil and natural gas. Chemical composition of oil and gas. Hydrocarbons of oil and petroleum products, gas sources. Paraffin hydrocarbons (alkanes).Naphthenic hydrocarbons (cycloalkanes) of oil. Isolation of individual substances and purification of hydrocarbon compounds; Unsaturated hydrocarbons, basic properties. Alkenes and alkynes are sources of monomer synthesis.Aromatic hydrocarbons..	5		
	Technology of production of surfactants	Structure of surfactants, classification of surfactants (nonionic and anionic), production of surfactants from higher fatty alcohols, the effect of surfactants on environmental components, applications, methods of determination (surface tension method, method of determining the edge angle (wetting angle) with a solid or liquid surface) the method of rotating droplet.	5	**КК3, КК4**	
	CAD Chemical Engineering II	The purpose of the discipline is to study the modeling of chemical and technological processes using the AspenHysys modeling software package. The course studies the basic concepts of the modeling method, methods of constructing a technological		5	**КК3, КК4, КК5**

		scheme, characteristics of the technological scheme and flows, calculation of parameters of all flows and equipment. The course forms the ability to develop an optimal chemical process technology with a high-quality output of the target product.		
	The main processes and apparatuses of chemical technology II	The purpose of studying the discipline: is to study the patterns and mathematical description of mass transfer processes occurring in systems with the presence of several phases and several components and the formation of knowledge and skills in the field of processes and apparatuses of chemical technology and practical calculations of processes and apparatuses. Mass transfer processes, calculation and selection of devices and structures; comparative analysis of the operation of devices, finding optimal conditions for technological processes.	4	**КК3, КК4, КК5**
	Technology of organic and petrochemical industries	To form a set of knowledge among students about the methods of conducting production processes, scientific thinking about understanding the logical connection between the chemical structure and the 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	**КК3, КК4, КК7**
	Automation of control systems in chemical and 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. Possession of sections of containers necessary for solving research and applied tasks. The course "ASUHTP" provides a presentation of the sections of the basics of TAR, measuring elements, functional circuits. 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 functional and mathematical model of the control system, to analyze the operation of the system based on qualitative indicators of regulation.	6	**КК3, КК4, КК5,КК6**
	Ecology and environmental protection of polymer enterprises	The purpose of mastering the discipline is to prepare students to solve the most important tasks of rational nature management, environmental protection and human health. Summary: The importance of environmental education for the future specialist in the production and processing of polymers. Special and extreme types of pollution that occur in the production of products made of polymer materials. Scientific and practical achievements in the field of industrial ecology, engineering environmental protection. Methods of development of new, more effective processes of neutralization,	6	**КК3, КК4, КК5,КК6**

		use of waste from polymer production.		
Cycle of profile disciplines University component				
	Polymer processing technology	The purpose of the discipline is for students to study the basic principles of polymer synthesis and their physical and mechanical properties. Free radical polymerization. Stepwise processes of polymer synthesis. Chemical reactions of polymers. Oxidation and aging of polymers. Structure and physical states of polymers. The concept of polydispersity and molecular mass distribution; mechanical properties of crystalline and glassy polymers; the strength of polymers. Classify and construct possible structures of polymers obtained by free radical polymerization and polycondensation; possess the features of the behavior of macromolecules and their supramolecular structures; link the physical characteristics of polymers with their structure and structure.	4	**КК3, КК4**
	Fundamentals of enterprise design	The purpose of the discipline is to study the structures, the principle of operation of basic and special equipment for chemical production, familiarization with its main components and details. At the end of the course, the student must know the basic principles of design and development of a feasibility study of production; parameters and modes of operation of standard equipment; typical processes of chemical technology, corresponding devices and methods of their calculation; requirements for the technical condition of equipment; methods of technological calculations of individual components and parts of chemical equipment.	5	**КК3, КК4, КК5**
	Polycondensation materials	The purpose of the discipline is for students to study the basic provisions of polymer synthesis by polycondensation Summary: Methods of obtaining synthetic polymers. Structure and classification of polycondensation polymers. The main types of polycondensation reactions, their conditions and mechanism. Monomers for polycondensation resins. Functionality of monomers. Cyclization as a competing reaction. Kinetics and MMR in polycondensation. Patterns of reversible and irreversible polycondensation. Methods of polycondensation. PC regularities in the melt, in solution, technological features. Emulsion polycondensation. Interphase polycondensation and its varieties.	4	**КК3, КК4, КК6**
	Fundamentals of industrial construction	The purpose of studying the discipline: mastering the basics of construction, analysis and design of the petrochemical industry. the main stages and design of petrochemical productions are considered. The main stages	6	**КК3, КК4, КК6**

		of designing enterprises of the petrochemical industry. Introduction to construction design. Selection and development of the technological scheme of the industry. The choice of technological construction of petrochemical plants. After mastering this discipline, the student must: know: the basics of the industry of the petrochemical industry based on the production method, the main types of construction and its technological calculation;;		
Cycle of profile disciplines Component of choice				
	Secondary polymer processes	Familiarization of students with the basics of secondary polymer processes. Recycling of secondary polymers. Problems of waste disposal. The composition of household waste. Methods of waste disposal. Disposal of polymer waste. Sources of polymer waste. Isolation of polymers from household waste. Methods of disposal of polymer waste. Features of secondary polymers. Recycling of secondary polymers into products. The use of recycled polymers. Chemical processing of polymer waste.	5	
	Recycling of polymer materials	The purpose of mastering the discipline is to form knowledge about the importance of waste recycling for solving environmental problems of polymer waste recycling plants. Summary: Analysis of the state of recycling of polymer materials, waste classification, waste recycling system in the world, features of recycling of polymer waste. The main methods of recycling polymer production waste. Methods of processing waste products for the production and processing of thermoplastic materials.		
	Chemistry and technology of paints and coatings	The purpose of teaching the discipline is to form students' basic theoretical knowledge and practical skills in chemistry and technology of film–forming polymers and coatings. Summary: Classification of paint and varnish materials. Theoretical regularities and physico-chemical foundations of the development of paint and varnish materials (LCM) and coatings. Synthetic film-forming substances. Technology of production and properties of coatings based on various synthetic polymers, petroleum polymer resins. Film-forming substances based on natural compounds.		
	Fundamentals of ionite production and application	Mastering the basics of the theory of ionites, analysis in the study by students of the basic provisions of the synthesis of ionites and their physical and mechanical properties. Chemical and technological issues of ion exchange sorption and desorption of ionites are considered. The main stages of obtaining	5	**КК3, КК4**

		complex ion-exchange electroneutral substances, highly concentrated electrolyte solutions. Fundamentals of the production and application of ionites, the main types of construction and its technological calculation; Be able to: build a kinetic model of the process and a technological scheme for the production and use of ionites based on the knowledge and information obtained from technical literature, including original sources		
	Economic aspects of organic matter technology	The purpose of the discipline is to form a set of knowledge among students 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.	6	
	Principles of chemical engineering	Familiarization of students with the basics of physico-chemical processes of chemical technology and familiarization with the principles of the device and calculation methods of devices designed to carry out these processes. The main processes of chemical technology. The absorption process. Hydrodynamic modes of packing columns. Formation of highly qualified specialists with general scientific and professional training, capable of independent creative work, to introduce the latest and progressive results into the production process and having an integrated knowledge system.	6	
	Physico-chemical methods of analysis	The course is designed to understand the principles of research and experimental work on modern analytical tools and practical use of the results and the data obtained. The purpose of the course is to teach students how to use FHMA to study the properties and composition of new organic materials and substances.Theoretical principles of methods, methods of computer processing of experimental results are described. Mass spectrometric methods. Electronic paramagnetic resonance (EPR) method. Nuclear magnetic resonance (NMR) method. Radiometric methods.		
	Technical analysis of polymers and polymer products	The purpose of the discipline is to form the theoretical and practical basis necessary for a chemical technologist in terms of conducting input, technical control of polymers and polymer products. Summary: The theoretical foundations of analytical control of production are considered; General information about metrology, standardization		

		in the system of technical control in chemical industry enterprises.Physical quantities as a measurement object. Methods for determining the physical parameters of polymers. General methods of analytical control; the main elements and objects of environmental control of production; chemical, physical and physico-chemical methods of analysis.		
	Quality control of polymer materials production	The main provisions for the creation of high-quality polymer materials for large-scale production of samples of new material using technological equipment and processes that meet all requirements with inexpensive raw materials, easy separation of clean products and the absence of environmental problems. This course is designed to familiarize with the basic concepts of chemical engineering for bachelors, the theory of quality control of polymer materials production; the theory of the theoretical basis of new standards; apply the acquired skills to solve questions on new materials.		
	Physical and mechanical testing of plastics	The purpose of studying the discipline is to instill in students the skills of conducting physical and mechanical testing of plastics. Summary: Examines the physical and mechanical properties of plastics, standardization and certification of plastic testing methods, standard test methods, the relationship of loading conditions of polymers and products made of them with their mechanical behavior and mechanical properties. Methods of testing polymer materials. Mechanical tests. Strength, deformation and tensile modulus of elasticity.		
	Nanocomposites and nanomaterials	The course is designed to provide training for students (bachelors in the discipline "Nanocomposites and nanomaterials") in accordance with the requirements in the areas of polymer production and processing technology. The purpose of studying the discipline "Nanocomposites and nanomaterials" is to study the main classes of nanomaterials and nanotechnologies used in the manufacture of photonics and optoinformatics devices and the development of disciplinary competencies.	5	**КК3, КК4**
	Fundamentals of obtaining composite materials	The purpose of the study is to give an in-depth understanding of the principles of creating polymer composite materials (PCM) with an improved complex of physico-chemical properties. Formation of students' ability to understand the physico-chemical essence of the processes of obtaining PCM and use the basic theoretical patterns in complex production and technological activities. Classification of composite materials according to materials science, structural, technological and operational	5	

		principles. Mastering this course allows you to expand your understanding of the principles of creating composite materials based on thermo- and reactoplasts, the theoretical foundations for choosing plastics to create products for a specific process of study to give an in-depth understanding of the principles of creating polymer composite materials (PCM) with an improved complex of physicochemical properties. Formation of students' ability to understand the physico-chemical essence of the processes of obtaining PCM and use the basic theoretical patterns in complex production and technological activities. Classification of composite materials according to materials science, structural, technological and operational principles. Mastering this course allows you to expand your understanding of the principles of creating composite materials based on thermo- and reactoplasts, the theoretical foundations for choosing plastics to create products for a specific purpose		
	Equipment of polymer production and processing enterprises	The purpose of studying the discipline is: students receive professional training in the design of polymer production and processing enterprises, study of standard equipment used for the production of polymers and their processing into products, substantiation of methods of production of plastic products, consumer goods. Study of the composition of the project (working draft), design and estimate documentation, the grounds for its development, the organizational foundations of the design of organic synthesis enterprises, the study of structures, the principle of operation of basic and special equipment for the production and processing of organic substances, familiarization with its main components and details, the development of methods and features of calculating the strength of elements of apparatuses and machines.Requirements for the design of chemical equipment..	5	**КК3, КК4, КК6**
	Fundamentals of design and equipment of organic synthesis enterprises	Study of the composition of the project (working draft), design and estimate documentation, the grounds for its development, the organizational foundations of the design of organic synthesis enterprises, the study of structures, the principle of operation of basic and special equipment for the production and processing of organic substances, familiarization with its main components and details, the development of methods and features of calculating the strength of elements of apparatuses and machines. Classification of equipment. Materials used for the manufacture of equipment. Design, technical projects, technological, mechanical	5	**КК3, КК4, КК6**

		calculations. Calculation of elements of devices.		

Curriculum of the educational program

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

SATBAYEV UNIVERSITY

APPROVED
Chairman of the Management Board-
Rector of Kaznitu named after K.Satpayev
M.M. Begentaev
«29» 04 2022 y.

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

Educational program 6B07216 - "Technology of the production and processing of polymers"
Group of educational programs B095 — «Chemical engineering and processes»

Form of study: full-time **Duration of study: 4 years** **Academic degree: Bachelor of Engineering 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 the 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 II	BD, UC	6	180	2/1/1	120	E			6					
CHE639	Organic Chemistry I	BD, UC	5	150	1/1/1	105	E				5				
CHE869	Physical and colloidal chemistry	BD, UC	5	150	1/1/1	105	E			5					
2201	Elective	BD, CCH	5	150	2/0/1	105	E			5					
CHE831	Surface phenomena and dispersed systems	BD, UC	5	150	2/0/1	105	E				5				
CHE637	Theoretical foundations of organic substances technology	BD, UC	5	150	2/0/1	105	E					5			
CHE649	Fundamentals of Chemistry and Monomer Technology	BD, UC	5	150	2/0/1	105	E				5				
CHE695	CAD Chemical engineering I	BD, UC	5	150	0/1/2	105	E					5			
CHE816	Basic processes and apparatus of chemical technology I	BD, UC	5	150	2/0/1	105	E					5			
CHE818	Technology for the production of polymers	BD, UC	5	150	2/0/1	105	E					5			
CHE652	Chemistry and Physics of Polymers	BD, UC	5	150	2/1/0	105	E					5			
3201	Elective	BD, CCH	5	150	2/0/1	105	E					5			
CHE699	CAD Chemical and Biological Engineering II	BD, UC	5	150	0/1/2	105	E						5		
CHE817	Basic processes and apparatus of chemical technology II	BD, UC	4	120	2/0/1	75	E						4		
CHE634	Technology of organic and petrochemical production	BD, UC	5	150	2/0/1	105	E						5		
4201	Elective	BD, CCH	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															
CHE819	Technology of polymer processing	PD, UC	4	120	2/0/1	75	E						4		
CHE560	Fundamentals of enterprise design	PD, UC	5	150	2/0/1	105	E						5		
CHE820	Polycondensation materials	PD, UC	4	120	2/0/1	75	E						4		
CHE821	Fundamentals of industrial construction	PD, UC	6	180	2/0/2	120	E							6	
4301	Elective	PD, CCH	5	150	2/0/1	105	E							5	

4302	Elective	PD, CCH	5	150	2/0/1	105	E							5		
4303	Elective	PD, CCH	6	180	2/0/2	120	E							6		
4304	Elective	PD, CCH	5	150	2/0/1	105	E							5		
4305	Elective	PD, CCH	5	150	2/0/1	105	E								5	
4306	Elective	PD, CCH	5	150	2/0/1	105	E								5	
4307	Elective	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																
ECA003	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																
AAP500	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 Kazntu named after K.Satpayev. Protocol № 13 **от "** 28 **"** 04 **20** 22 **y.**

Decision of the Educational and Methodological Council of Kazntu named after K.Satpayev. Protocol № 7 **от "** 26 **"** 04 **20** 22 **y.**

Decision of the Academic Council of the Institute_____. Protocol № 4 **от "** 30 **"** 12 **20** 21 **y.**

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

Director of IGaOGB — **Syzdykov A.H.**

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

Specialty Council representative from employers — **Kalmuratova A.A.**

SATBAYEV UNIVERSITY

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

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

MAJOR ELECTIVE DISCIPLINES educational program for the 2022-2023 academic year admission
Educational program 6B07216 - "Technology of the production and processing of polymers"
Group of Educational programs B069-"Production of materials (glass, paper, plastic, wood)"

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	CHE870	Fundamentals of analytical chemistry of organic substances	3	B	5	150	2/0/1	105	
		CHE454	Fundamentals of quality control of organic compounds					2/0/1		
	3201	CHE871	Chemistry of hydrocarbons	5	B	5	150	2/0/1	105	
		CHE877	Technology of production of surfactants					2/0/1		
	4201	AUT434	Automation of control systems in chemical engineering processes	7	B	6	180	2/1/1	120	
		CHE872	Ecology and environmental protection of polymer enterprises					2/1/1		
			M-8. Module of professional chemical and technological activity							
4	4301	CHE405	Secondary polymer processes	7	S	5	150	2/0/1	105	
		CHE873	Recycling of polymeric materials					2/0/1		
	4302	CHE874	Chemistry and technology of paints and varnishes and coatings	7	S	5	150	2/0/1	105	
		CHE822	Basics of production and application of ion exchangers					2/0/1		
	4303	CHE833	Economic aspects of the technology of organic subsstances	7	S	6	180	2/0/2	120	
		CHE829	Principles of chemical engineering					2/0/2		
	4304	CHE893	Physico-chemical methods of analysis	7	S	5	150	2/1/0	105	
		CHE875	Technical analysis of polymers and polymer products					2/0/1		
	4305	CHE824	Quality control of the production of polymeric materials	8	S	5	150	2/0/1	105	
		CHE876	Physical and mechanical testing of plastics					2/0/1		
	4306	CHE825	Nanocomposites and Nanomaterials	8	S	5	150	2/0/1	105	
		CHE823	Fundamentals of obtaining composite materials					2/0/1		
	4307	CHE826	Equipment for polymer production and processing enterprises	8	S	5	150	2/0/1	105	
		CHE485	Basics of designing and equipment of enterprises of organic synthesis					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 the development of additional educational programs (Minor)

CHANGE REGISTRATION SHEET

Sequence number of the change	Section, paragraph of the document	Type of change (replace, cancel, add)	Number and date of notification	The change has been made	
				Date	Surname and initials, signature, position