Ministry of Health of the Russian Federation
«Saint Petersburg State Chemical and Pharmaceutical University»

APPROVED
Rector
Federal State Budgetary Educational Institution
of Higher Education
Saint Petersburg State Chemical and
Pharmaceutical University
_____ Narkevich I.A.
«____» _____ 2025

Ministry of Science and Higher Education of the Republic of Kazakhstan
«South Kazakhstan Medical Academy»

APPROVED
Rector of JSC «SKMA»
Seitzhanova Zh.S.
«27» 03 2025

JOINT EDUCATIONAL PROGRAMME

Group of the Joint Educational Programme:	**B072 «Technology of Pharmaceutical Production»**
Joint Educational Programme Code:	**6B07207 «Technology of Pharmaceutical Production»**
Title of the Joint Educational Programme:	**«Technology of Pharmaceutical Production»**
Level of the Joint Educational Programme:	**Bachelor's Programme**

Saint Petersburg, Russian Federation
Shymkent, Republic of Kazakhstan, 2025

The Joint Educational Programme 6B07207 "Technology of Pharmaceutical Production" developed by the members of the AC of EP "Pharmaceutical Production Technology"

Chairman of the AC of EP "Pharmaceutical Production Technology" Torlanova B.O.
Protocol № 6 dated 24.02 2025

Approved by Employers:

Director of LLP "Phyto-Apipharm" Korotkov A.V.

Director of LLP "Zerde-Phyto" Shuynshaliev S.A.

Director of the Association of Legal Entities "Association of Pharmaceutical and Medical Organizations 'Damu'" Alzhanova H.D.

Approved by the Methodological Council

Vice-rector for academic work Anartaeva M.U.
Protocol No. 8, dated 31.03. 2025

Approved by the Academic Council
Protocol No. 11, dated 31.03 2025

PASSPORT OF THE EDUCATIONAL PROGRAM

1. **Mission of the Educational Program**: To prepare competitive, highly qualified specialists for the pharmaceutical industry of the Republic of Kazakhstan and neighboring countries.
2. **Goal of the Educational Program**: To train specialists for the industrial production of medicines and medical products in accordance with GMP requirements in the Republic of Kazakhstan.
3. **Justification of the Educational Program**: Based on the integration of education and science, create an effective system for training specialists capable of efficiently solving management tasks in professional activities using information and communication technologies.
4. **Professional Standard on the Basis of Which the Educational Program is Developed**:
   Regulatory documents for the development of the educational program:
   Order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated August 27, 2024, No. 419.
5. **Field of Professional Activity**: Pharmaceutical industry, perfumery-cosmetic, chemical, microbiological, biotechnology, food industries, science, and education.
6. **Objects of Professional Activity**: Large and small-scale chemical-pharmaceutical enterprises and pharmaceutical production, enterprises for the production of medical preparations and medical devices, biotechnology productions, perfumery-cosmetic productions, food production, departments of technical control, central factory laboratories, laboratories for the standardization and quality control of medicines, bodies of standardization, certification, and licensing.

General information

№	Name of the field	Note
1	Registration number	6B07200274
2	Code and classification of area of education	**6B7 Engineering, processing and building industries** Order of Minister for education and science of Republic of Kazakhstan from October, 13, 2018 № 569 "About claim of Classifier of directions of training of personnels with higher and post-diploma education" (with amendments and additions dated June 5, 2020, Order of the Minister of Education and Science of the Republic of Kazakhstan No. 234)
3	Code and classification of directions of preparation	**6B072 "Productive and processing industries"** Order of Minister for education and science of Republic of Kazakhstan from October, 13, 2018 № 569 "About claim of Classifier of directions of training of personnels with higher and post-diploma education" (with amendments and additions dated June 5, 2020, Order of the Minister of Education and Science of the Republic of Kazakhstan No. 234)
4	Group of the educational programs	**B072 "Technology of pharmaceutical production"** Order of the Ministry of Education and Science of the Republic of Kazakhstan No. 204 dated 02.05.2017 "On approval of the Rules for conducting the Unified National Testing and provision of public Services "Issuance of a certificate of passing the Unified National Testing"" (with amendments and additions dated April 20, 2023, Order of the Minister of Science and Higher Education of the Republic of Kazakhstan No. 173).
5	Name of the educational program	**"Technology of pharmaceutical production"**
6	Type of the educational program	**Operating educational program**
7	Level on International standard classification of education Уровень по МСКО	**0720**
8	Level on the National scope of qualifications	**6**
9	Level on the branch scope of qualifications	**6**
10	Distinctive features of the educational	**No**

	program	
	Institution-partner (Joint educational program)	**No**
	Institution-partner (Twodiploma educational program)	**No**
11	List of competenses	**Universal competencies:** **UC 1** Able to conduct information search, critical analysis, and synthesis, and apply a systems approach to solve assigned tasks. **UC 2** Able to determine the range of tasks within the framework of the set goal and choose the best ways to solve them, based on current legal norms, available resources and limitations. **UC 3** Able to carry out social interaction and realize role in the team. **UC 4** Able to carry out business communication in oral and written forms in the official language of the Russian Federation and a foreign language(s) **UC 5** Able to perceive the intercultural diversity of society in socio-historical, ethical and philosophical contexts. **UC 6** Able to manage his time, build and implement a trajectory of self-development based on the principles of lifelong education. **UC 7** Able to maintain an adequate level of physical fitness to ensure full-fledged social and professional activities **UC 8** Able to create and maintain safe living conditions in daily life and in professional activities to preserve the natural environment and ensure the sustainable development of society, including in the event of threats and emergencies and military conflicts. **UC 9** Able to use basic defectological knowledge in social and professional spheres. **UC 10** Able to make informed economic decisions in various areas of life **UC 11** Able to form an intolerant attitude towards manifestations of extremism, terrorism, and corrupt behavior and to counteract them in his professional activities. **General professional competencies:** **GPC 1**. It is able to study, analyze, use the mechanisms of chemical reactions occurring in technological processes and the world around it, based on knowledge of the structure of the substance, the nature of the chemical bond and the properties of various classes of chemical elements, compounds, substances and

		materials **GPC 2**. Able to use mathematical, physical, physical-chemical, chemical methods to solve problems of professional activity **GPC 3**. Able to carry out professional activities taking into account the legislation of the Russian Federation and the Republic of Kazakhstan, including in the field of economics and ecology **GPC 4**. Capable of ensuring the technological process, using technical means to control the parameters of the technological process, the properties of raw materials and finished products, to change the parameters of the technological process when the properties of raw materials change **GPC 5**. Able to carry out experimental studies and tests according to a given method, conduct observations and measurements taking into account safety requirements, process and interpret experimental data **GPC 6**. Able to understand the principles of modern information technology and use them to solve problems of professional activity **Professional competencies:** **PC 1**. Able to carry out quality control of pharmaceutical production **PC 2.** Able to carry out technological processes in the manufacture of medicines **PC 3.** Capable of performing work related to the pharmaceutical quality system for the manufacture of medicinal products **PC 4.** Able to carry out pharmaceutical development of medicinal products **PC 5.** Able to develop technological documentation in the industrial production of medicines
12	Results of educating	**LO 1** Demonstrates an understanding of current trends and prospects for the development of the pharmaceutical industry, taking into account digitalization, in relationship and interdependence with other social spheres, including in the field of ecology, in accordance with the requirements of the legislation of the Russian Federation and the Republic of Kazakhstan **LO 2** Applies the basic requirements of existing external and internal regulatory and technical documents and acts of the Russian Federation and the Republic of Kazakhstan, as well as in the process of their updating, for the organization and implementation of technological processes in pharmaceutical production **LO 3** Applies the patterns of chemical and technological processes at a professional level using digital technologies to organize the technological process in pharmaceutical production for the production of specific pharmaceutical and medical products

		LO 4 Defines the scope of tasks within the set goal and selects optimal methods for their solution, based on the current legal norms of the Russian Federation/Kazakhstan Republic for organizing and managing human resources to implement the technological process and solve production tasks in accordance with the production strategy **LO 5** Ensures the organization and safety of technological processes, including in accordance with inclusion requirements, using intelligent monitoring systems and digital solutions to control the condition of equipment, automation of production processes and compliance with regulatory requirements. **LO 6** Identifies risks and causes of non-conformities in production, proposes unconventional solutions in critical situations based on the use of production information in conditions of choice and variety of methods, and takes responsibility for them. **LO 7** Collects, analyzes, and processes data using artificial intelligence tools and digital platforms for conducting research/experimental work, developing new technologies, and expanding the range of pharmaceutical and medical products. **LO 8** Develops scientifically-based projects and business plans, relying on the use of artificial intelligence elements, the implementation of digital technologies in technological processes, and the well-reasoned defense (written and oral – reports, presentations, articles) of innovative solutions **LO 9** Develops and implements plans to improve the efficiency of the results of production, research work based on the analysis of technical and economic indicators of production. **LO 10** Develops internal regulatory and technical documentation for quality control of raw materials, semi-finished products, finished products, ensuring proper maintenance of technological equipment, automation means, and measuring instruments, and ensures their timely updates **LO 11** Possesses critical thinking, relying on the analysis of social, political, and cultural processes, the use of digital technologies in professional communication, and the application of language competencies in intercultural interaction with different specialists at various levels to solve production tasks. **LO 12** Independently builds and implements a trajectory of continuous self-development and advanced training based on the principles of education throughout life, taking into account modern trends in the development of the pharmaceutical industry.
13	Form of educating	
14	Language of educating	Russian
15	Common amount of credits	240 credits
16	Four-year program	4 year

17	Awarded academic degree	Bachelor
18	Presence of Appendix to the license to direction of preparation of specialists	
19	Presence of accreditation of the educational program	
	Name of accreditation organ	
	Term of action of accreditation	
20	Information about disciplines	*Appendix A.2*

Application A.1

Matrix of correlation of learning outcomes for the educational program in general with the formed competencies in educational program 6B07201 - "Technology of pharmaceutical production"

	LO 1	LO 2	LO 3	LO 4	LO 5	LO 6	LO 7	LO 8	LO 9	LO 10	LO 11	LO 11
KC 1	+						+				+	
KC 2			+				+				+	
KC 3	+	+		+			+					+
KC 4			+	+	+	+						
KC 5								+	+			
KC 6	+		+		+							
KC 7								+		+		+
KC 8			+	+		+						
KC 9			+			+				+		
KC 10			+					+				+
KC 11							+	+		+	+	

Application A.2

Competency/Learning Outcome Achievement Matrix

№	Name of discipline	Short description of discipline (30- 50 words)	Cycle (GED,BD,SD)	Component (MC, UC,EC)	Amount of credits	Formed Lear-ning outcomes LO (codes)
1	2	3	4	5	6	7
Cycle of General Educational Disciplines (GED) Mandatory Component (MC)/ Elective Component(EC)					**56**	
1	**History of Kazakhstan**	Purpose: Formation of the worldview, civic, and moral positions of the future specialist based on a deep understanding and scientific analysis of the idea of the national state of Kazakhstan on its path to Independence. Contents: Features of industrial development. Civil-political confrontation. Formation of the state structure of the Republic of Kazakhstan. Kazakhstan's model of economic development, including the pharmaceutical industry. Socio-political development prospects and spiritual modernization.	GED	MC	5	LO8 LO11 LO12
2	**Kazakh (Russian) language**	Purpose: Formation of the ethics and etiquette of business speech in professional communication of a pharmaceutical production engineer, and skills in drafting and analyzing business documents. Contents: The communicative task of scientific texts in pharmacy. The language of the specialty and the professional speech culture of a pharmaceutical production worker. Fundamentals of scientific and business rhetoric. Business contacts and negotiation skills in the pharmaceutical production field. Artificial Intelligence: basics of working with Python programming – analysis of texts and videos.	GED	MC	10	LO 10 LO 11
3	**Foreign language**	Purpose: Formation of the ethics and etiquette of business speech in	GED	MC	10	LO 8 LO 11

		professional communication of a pharmaceutical production engineer, and skills in drafting and analyzing business documents in a foreign language. Contents: Lexical minimum of commonly used words and phrases, and the terminological minimum in the specialty "Technology of Pharmaceutical Production." Development of the professional speech of a pharmaceutical production engineer: skills in reading, listening, and note-taking of pharmaceutical literature; composing various types of written texts.				LO 12
4	**Information and communication technology**	Purpose: Formation and development of skills to critically evaluate and analyze processes, methods of searching, storing, and processing information, as well as ways of collecting and transmitting information using digital technologies. Contents: Fundamental concepts of information and communication technologies, including computer system architecture, types of software, database systems, data analysis and management, network technologies, cybersecurity, internet technologies, cloud technologies, multimedia technologies, smart technologies, basics of artificial intelligence and its applications.	GED	MC	5	LO 5 LO 7 LO 8
5	**Philosophy**	Purpose: Formation of skills to evaluate the surrounding reality based on worldview principles formed on the knowledge of the fundamentals of philosophy, ensuring scientific understanding and study of the natural and social world using scientific-philosophical methods of cognition. Contents: Philosophy is a special form of cognition that develops a system of knowledge about the fundamental principles and foundations of human life, and about the most significant characteristics of all main manifestations of human relations to nature, society, and spiritual life. Subject, tasks, and functions of philosophy. National philosophy. Cognitive theory. Globalization and modern Kazakhstan.	GED	MC	5	LO 11 LO 12
6	**Physical**	Purpose: Formation of skills in using physical culture tools for health	GED	MC	8	LO 11

	education	improvement, as well as for the development and enhancement of physical qualities and motor abilities. Contents: Understanding the social role and values of physical culture in the professional and personal development of the future specialist. Promotion of a healthy lifestyle and mastery of health preservation skills.				
7	**The module of socio-political knowledge (sociology, political science, cultural studies, psychology)**	Purpose: To develop general competencies that ensure the socio-cultural development of the future specialist's personality, based on worldview, civic and moral positions, as well as skills for lifelong self-development and self-education. Contents: Understanding the institutions of the social world, social theory, aspects of healthcare, political science, global politics, culture of Kazakhstan, and digital technologies. Study of personality psychology, values, artificial intelligence, and its impact on society.	GED	MC	8	LO 1 LO 7 LO 8 LO11 LO12
8	**Legal, financial, economic, environmental and scientific knowledge ***	*Integrated discipline* Purpose: Formation of moral and civic positions based on financial-economic, legal, environmental, and scientific knowledge. Contents: Development of competencies in the field of social, business, and legal norms for self-development and education. Nature protection, environmental issues, the concept of sustainable development. Regulatory and technical basis of labor safety, anti-corruption policy, legal responsibility for corruption in healthcare. Business planning, financial literacy, critical thinking, and application of scientific methods.	GED	EC	5	LO 1 LO 8 LO 10 LO11 LO12
9	**Fundamentals of Economics and Law***	Purpose: To equip students with knowledge of the basics of economics and law necessary for successful activity in the pharmaceutical industry, as well as to develop skills in critical thinking, designing, and implementing innovative solutions considering current trends and digitalization. Contents: Study of the basics of economics and law in the context of the pharmaceutical industry, including environmental aspects and	GED	EC		LO 1 LO 8 LO 10 LO11 LO12

		legislative requirements. Development of business plans, scientifically grounded projects, regulatory documentation, and quality control skills. Mastery of critical analysis methods and intercultural interaction for solving production tasks.				
10	**Fundamentals of anti-corruption culture and entrepreneurship skills***	Purpose: To develop knowledge about anti-corruption culture and entrepreneurial skills, promote the development of critical thinking, digital competencies, and the ability to design innovative projects, business plans, and regulatory documentation for successful professional activity and personal growth in modern society. Contents: Study of anti-corruption principles, fundamentals of entrepreneurship, modern technologies and digital solutions, development of business plans and regulatory documents, as well as development of intercultural communication skills, critical analysis, and time management for personal and professional development.	GED	EC		LO 1 LO 8 LO 10 LO11 LO12
11	**Ecology, sustainable development and life safety, scientific research methods***	Purpose: To develop knowledge and skills in ecology, sustainable development, and life safety considering the pharmaceutical industry, foster critical thinking, and the ability to apply digital technologies for developing scientifically based projects and ensuring effective process management. Contents: Study of environmental aspects of the pharmaceutical industry, principles of sustainable development, life safety, research methods, digital technologies, development of regulatory documentation, analysis of technical and economic indicators, intercultural communication, and self-development in professional activities.	GED	EC		LO 1 LO 8 LO 10 LO11 LO12
Cycle of Basic Disciplines –BD University Component (UC)/ Elective Component(EC)					**134**	
1	**History of Russia**	Purpose: To develop students' critical thinking and analytical skills through the study of Russian history, including social, political, and cultural processes. To master the use of digital technologies and language competencies for professional communication and	BD	UC	4	LO11 LO12

		intercultural interaction, as well as to enhance time management and self-development skills in the context of historical knowledge. Contents: Study of the stages of Russia's historical development in the context of world history, cultural traditions, heritage, and the sociocultural characteristics of various social groups.				
2	**Fundamentals of Russian Statehood**	Purpose: To develop in students a deep understanding of the foundations of Russian statehood, including key social, political, and cultural processes, as well as to foster critical thinking and analytical skills. To train in the use of digital technologies for professional communication and intercultural interaction, along with time management and self-development based on historical knowledge. Contents: Study of the cultural characteristics and traditions of social groups, choice of value orientations and civic stance; reasoned discussion and resolution of worldview, societal, and personal issues.	BD	UC	3	LO11 LO12
3	**Economic and mathematical methods of production management based on mathematical analysis methods**	Purpose: To develop practical skills in applying mathematical analysis methods to solve problems related to the organization and management of labor resources, as well as to ensure the safety and efficiency of technological processes, including the optimization of production processes in accordance with the legal norms of the Russian Federation and the Republic of Kazakhstan. Contents: Mastering the basic elements of mathematical analysis (limits, derivatives, integrals, and differential equations) to describe the dynamics of technological processes using methods of rational/optimal organization of pharmaceutical production.	BD	UC	4	LO 4 LO 5
4	**Electrical engineering and fundamentals of industrial**	Purpose: To provide students with basic knowledge and practical skills in electrical engineering and industrial electronics for understanding the principles of operation of electrical equipment, automation, and control systems in pharmaceutical production. Contents**:** Fundamentals of industrial electronics: semiconductor devices, power electronics, sensors, and converters. Basics of electrical	BD	UC	3	LO6 LO12

	electronics	engineering, methods of calculation and analysis of electrical circuits. Application of electrical measuring instruments and technical aspects of designing modern analog, digital, and microprocessor-based devices for selecting electrical equipment and electronic systems.				
5	**Energy resources, sources and methods of obtaining - Energy sources**	Purpose: To develop in students a comprehensive understanding of energy resources, sources, and methods of energy generation used in industry, especially in the pharmaceutical sector, and to build skills in the rational use of energy, improvement of energy efficiency, and ensuring the safety of energy systems. Contents: Traditional and renewable resources, their sources, principles of extraction and conversion into energy, technologies for the production of electricity, heat, and cooling. Application of energy efficiency measures, sustainable resource use, methods for reducing energy costs, and optimizing energy consumption at pharmaceutical enterprises.	BD	UC	5	LO6 LO12
6	**Processes and apparatuses of chemical technology**	Purpose: To develop students' understanding of the patterns of chemical-technological processes (CTPs) and the operation of equipment in pharmaceutical production. To enhance skills in using digital technologies for analyzing, modeling, and optimizing CTPs, selecting equipment, and organizing processes in accordance with regulatory requirements. Contents: Patterns of mechanical processes in pharmaceutical production; classification and design features of hydromechanical and hydrodynamic processes; preparation of material and energy balances, determination of the main dimensions of process equipment.	BD	UC	6	LO3 LO4 LO12
7	**Educational practice**	Purpose: To familiarize students with the general structure of a pharmaceutical enterprise, the functions of its structural units and their technical equipment, the design and operating principles of machines and automated systems for filling and packaging finished dosage forms and intermediates, as well as the rules for their operation. Contents: Introduction to safety regulations and industrial sanitation	BD	UC	3	LO2 LO3 LO7 LO12

		practices, working with technical and technological instructions, as well as reference and scientific literature for analyzing the operation and performing calculations of key technological equipment.				
8	**Mass transfer processes and apparatuses of chemical technology**	Purpose: To develop students' knowledge and practical skills in mass transfer processes used in pharmaceutical technology. To teach the principles of operation of mass transfer equipment, methods of calculation and optimization of separation and purification processes, and the application of digital technologies for process modeling and control. Contents: Principles of mass transfer and biochemical processes in pharmaceutical production, mass transfer during changes in the state of substances, preparation of material and energy balances, classification and design features of adsorption, extraction, and crystallization equipment. Fundamentals of kinetic and design calculations of processing equipment.	BD	UC	**5**	LO3 LO4 LO12
9	**Chemistry of biologically active substances**	Purpose: To develop students' understanding of the structure, properties, and methods of obtaining biologically active substances (BAS) used in the pharmaceutical industry. To teach the application of knowledge about BAS chemistry in the context of modern trends, including digitalization and the legal requirements of the Russian Federation and the Republic of Kazakhstan. Contents: Study of methods for obtaining and the properties of biologically active substances based on synthetic and natural origin compounds, as well as methods of analysis and quality control of synthetic and natural medicinal products, medicinal plant raw materials, and dosage forms based on them.	BD	UC	3	LO 1 LO 2 LO 10
10	**General chemical technology**	Purpose: To develop students' understanding of the principles and patterns of chemical technology, as well as methods for organizing and optimizing chemical-technological processes (CTPs) across various industries, including the pharmaceutical sector. To teach the use of digital technologies for analyzing, modeling, and managing CTPs, and	BD	UC	4	LO 3 LO 4 LO12

		selecting optimal solutions in compliance with regulatory requirements and labor resources. Contents: Study of production efficiency evaluation criteria, chemical process patterns, industrial catalysis, and chemical reactors. Design of chemical-technological systems, their structure, and raw material subsystems.				
11	**Technology of extraction preparations**	Purpose: To develop in students in-depth knowledge and practical skills in the technology of manufacturing extraction-based preparations, with a focus on improving production efficiency, developing and updating regulatory documentation, and ensuring quality control of raw materials, intermediates, and finished products. Contents: Study of manufacturing technologies for extraction preparations from plant and animal raw materials, and methods for quality control. General technology for the production of tinctures, extracts, novogalene preparations, and preparations of individual substances.	BD	UC	5	LO 9 LO10
12	**Production practice** **(Technological design and technology practice)**	Purpose: To study the structure and development prospects of the enterprise (internship base), the range of manufactured products, and to become familiar with activities aimed at production expansion. Contents: Deepening and systematization of knowledge acquired in general professional and specialized disciplines; development of skills in conducting expert evaluations and modeling technological processes for the production of pharmaceutical drugs.	BD	EC	6	LO 8 LO 9 LO10
13	**Mathematics - part 1***	Purpose: To develop students' basic mathematical knowledge and skills for the application of digital technologies in the analysis of chemical-technological processes, data processing, and modeling in the pharmaceutical and medical industries, contributing to the organization of technological processes and scientific research activities. Contents: This course covers the fundamentals of linear algebra and analytic geometry necessary for the mathematical modeling of technological processes in pharmaceutical production. Topics include	BD	EC	5	LO 3 LO 7

		matrices, systems of linear equations, fundamentals of vector algebra, and analytic geometry. MathCAD and Excel are used during the learning process.				
14	**Mathematics, fundamentals of probability theory and mathematical statistics-1***	Purpose: To equip students with basic knowledge and skills in mathematics, probability theory, and statistics necessary for applying digital technologies in the analysis of chemical-technological processes, production organization, data processing, scientific research, and the development of pharmaceutical products. Contents: Application of systems of linear algebraic equations to model chemical and physical processes during the production of dosage forms. Use of analytic geometry in the design of pharmaceutical manufacturing facilities.	BD	EC		LO 3 LO 7
15	**Mathematics - part 2***	Purpose: To deepen students' mathematical knowledge and develop skills in applying mathematical methods, digital technologies, and artificial intelligence for the analysis and optimization of chemical-technological processes, the development of pharmaceutical products, and data-driven decision-making. Contents: This course covers the fundamentals of probability theory and mathematical statistics, including random variables, distribution laws, sample characteristics, and hypothesis testing. It explores the use of statistics for data analysis and quality control in the pharmaceutical industry. MathCAD and Excel are used during the learning process.	BD	EC	5	LO 4 LO 5
16	**Mathematics, fundamentals of probability theory and mathematical statistics-2***	Purpose: To deepen and expand students' knowledge in mathematics, probability theory, and mathematical statistics, and to develop skills in applying this knowledge for analyzing complex chemical-technological processes, optimizing technological regimes in pharmaceutical production, processing large volumes of data, conducting advanced scientific research, and developing innovative pharmaceutical and medical products using digital technologies and artificial intelligence tools. Contents: First-order differential equations. Second-order linear	BD	EC		LO 4 LO 5

		differential equations. Nonhomogeneous second-order differential equations with constant coefficients. Application of probability theory and mathematical statistics in solving industrial problems. Statistical distribution of samples. Mathematical modeling.				
17	**Equipment and fundamentals of pharmaceutical production design***	Purpose: To develop students' knowledge and skills in designing pharmaceutical production facilities, including the use of artificial intelligence and digital technologies for creating innovative solutions, as well as preparing scientifically grounded projects and business plans with a focus on production efficiency. Contents: Study of the main types of equipment used in pharmaceutical production, their operating principles, and the fundamentals of pharmaceutical production design.	BD	EC	6	LO 8 LO 9 LO10
18	**Fundamentals of production design***	Purpose: To develop students' knowledge and skills in designing pharmaceutical production facilities considering modern technologies. To train students in developing scientifically justified projects and business plans, and in implementing digital technologies and artificial intelligence to improve process efficiency and quality control. Contents: Familiarization with regulatory documents (SNiPs, GOSTs). Requirements for the structure and content of a project. Technical and economic justification of the design. Master plan for pharmaceutical production. Building design in accordance with GMP standards and the needs of people with disabilities. Layout of technological equipment in industrial buildings.	BD	EC		LO 8 LO 9 LO10
19	**Chemistry and technology of phytopreparations***	Purpose: To develop students' knowledge and skills in the chemistry and technology of phytopharmaceuticals to enhance the efficiency of production and research processes. Training in documentation development, quality control of raw materials and products, as well as maintenance of technological equipment and measuring instruments. Contents: Study of the chemical composition, methods of obtaining and quality control of phytopharmaceuticals, theory of extraction, and	BD	EC	5	LO 9 LO10

		technologies of galenic preparations. Analysis of technical and economic production indicators. Development of documentation for quality control of raw materials and finished products, and ensuring maintenance of equipment and measuring devices in pharmaceutical production.				
20	**Chemistry of natural medicinal compounds***	Purpose: To develop students' knowledge and skills in the chemistry of natural medicinal compounds with an emphasis on improving the efficiency of production and research processes. Training in the development of regulatory documentation, quality control of raw materials and products, as well as technical maintenance of equipment and measuring instruments. Contents: Classification and distribution of biologically active substances in plants. Methods for determining the structure, extraction, separation, and identification of plant-derived medicinal substances. Study of the structure, properties, and analysis of natural compounds. Technologies for obtaining and quality control.	BD	EC		LO 9 LO10
21	**General and Inorganic Chemistry**	Purpose: To develop students' deep knowledge of the chemical foundations of the pharmaceutical industry, understanding the interconnections with ecology and legislation, as well as skills in applying modern digital technologies to optimize technological processes and ensure their safety. Contents: Study of the fundamentals of general and inorganic chemistry, analysis of chemical processes in pharmaceuticals, examination of regulatory and technical documents covering the legislation of the Russian Federation and Kazakhstan, and the application of intelligent monitoring systems to ensure the safety and efficiency of technological processes in production.	BD	UC	6	LO1 LO 2 LO 5
22	**Engineering graphics**	Purpose: To develop students' skills in graphical representation of engineering solutions, master design standards and regulations, and foster the ability for self-directed learning and time management for professional growth.	BD	UC	3	LO2 LO12

		Contents: Knowledge of engineering graphics, use of CAD (Computer-Aided Design) systems, AutoCAD. Skills in creating 3D models, visualization, and object editing. Mastery of geometric drawing, fittings, and projection drawing.				
23	**Statistical data processing methods using software and artificial intelligence tools**	Purpose: To develop students' competencies in statistical data analysis using modern software and AI tools to address organization, control, and safety of technological processes, optimize production, conduct research, and improve pharmaceutical product efficiency. Contents: The course covers statistical methods for data analysis, quality control, and process optimization in pharmaceuticals. It includes descriptive and comparative statistics, parametric and non-parametric methods, normality testing, correlation and regression analysis. Practical work is conducted using Excel, Statistica, and AI tools.	BD	UC	3	LO 3 LO 5 LO 7 LO 9
24	**Physics**	Purpose: To develop students' skills in applying optical, acoustic, mechanical, and electrical phenomena in pharmaceutical production. To study the effects of infrared and ultraviolet radiation, ultrasound, and diffusion on the efficiency and quality of pharmaceutical products. Contents: The course covers the laws of molecular-kinetic theory and hydrodynamics at various stages of pharmaceutical production, as well as the significance of direct and alternating current. Digital technologies and artificial intelligence tools are used for problem-solving.	BD	UC	8	LO 3 LO 5 LO 7 LO 8
25	**Principles of Safe Organization of Production Processes**	Purpose: To develop students' skills in organizing safe production processes using digital monitoring and automation systems. Contents: Studying the principles of safe organization of production processes, regulatory requirements, monitoring and automation systems. Mastering methods of risk identification and assessment, accident prevention, developing skills of independent planning and professional development using digital technologies based on	BD	UC	4	LO 5 LO12

		knowledge of legal norms, ISO 45001 and OHSAS standards to ensure the safety of employees at pharmaceutical enterprises, as well as organizing measures to prevent harmful factors.				
26	**Organic Chemistry-1**	Purpose: To provide students with in-depth knowledge in organic chemistry, understanding its role in the pharmaceutical industry, as well as skills in developing and applying regulatory and technical documentation for quality control and ensuring safety of technological processes in accordance with current legislative requirements. Contents: The course covers fundamental principles of organic chemistry, including the structure and properties of organic compounds, reactions, and mechanisms. It addresses quality control of raw materials and products, as well as the development of internal documentation. Special attention is given to the relationship between organic chemistry, ecology, and modern trends in the pharmaceutical industry.	BD	UC	4	LO 1 LO2 LO10
27	**Materials Science**	Purpose: To equip students with knowledge about the properties and applications of various materials used in the pharmaceutical industry, as well as an understanding of their interrelation with ecology and legislation. To develop skills in preparing regulatory documentation for quality control and safe use of materials in production. Contents: Study of classification and properties of materials, their role in pharmaceutical manufacturing. Examination of regulatory requirements for raw materials and products, quality control methods. Mastery of documentation development for equipment maintenance and compliance with environmental standards.	BD	UC	3	LO2 LO12
28	**Fundamentals of economics and management**	Purpose: To develop students' knowledge and skills in the economics and management of pharmaceutical production, considering the regulatory and technical requirements of Russia and Kazakhstan. To foster abilities for independent time planning and continuous professional growth for effective management of production processes.	BD	UC	4	LO1 LO2 LO9 LO11 LO12

	of pharmaceutical production	Contents: Study of the basics of pharmaceutical industry economics, regulatory documents and acts of the Russian Federation and Kazakhstan applied in technological production. Examination of resource management methods, production planning and organization. Formation of skills in self-organization, time management, and continuous self-development in professional activities.				
29	**Physical chemistry**	Purpose: To develop students' knowledge of the physical and chemical fundamentals necessary for understanding processes in the pharmaceutical industry. To enhance skills in applying regulatory documents and digital technologies to ensure the safety and efficiency of technological processes in production. Contents: Study of thermodynamics, kinetics, and equilibrium in the context of pharmaceutical processes. Topics include substance interactions, methods for process control and optimization, as well as the application of regulatory and technical documentation. Mastering monitoring and automation technologies to ensure safety and compliance with legal requirements.	BD	UC	4	LO1 LO2 LO5
30	**Organic chemistry-2**	Purpose: To provide students with in-depth knowledge of organic compounds, their properties and reactions, as well as understanding their role in the pharmaceutical industry. To develop skills in drafting regulatory documentation for quality control and ensuring the safe use of organic substances in production processes. Contents: Study of the structure, properties, and reactivity of organic compounds and their applications in pharmaceutical manufacturing. Examination of regulatory and technical documents and quality requirements for raw materials and finished products. Mastery of quality control methods and documentation development to ensure proper equipment maintenance and compliance with regulatory standards.	BD	UC	6	LO 1 LO2 LO10

31	**Colloidal chemistry**	Purpose: To familiarize students with the fundamentals of colloid chemistry, its role in the pharmaceutical industry, environmental aspects, and regulatory requirements. To develop skills in quality control, documentation development, and the use of digital technologies to ensure the safety and efficacy of pharmaceutical products. Contents: Study of the properties of colloidal systems, methods of their stabilization and analysis. Review of regulatory standards and quality requirements. Mastery of methods for controlling technological processes, automation, and equipment condition monitoring using digital solutions.	BD	UC	3	LO1 LO2 LO5
32	**Analytical chemistry**	Purpose: To develop students' knowledge and skills in analytical chemistry, including methods for analyzing and quality control of pharmaceutical products. To enhance understanding of the relationship between analytical processes, legislative requirements, and modern trends in the pharmaceutical industry, including aspects of digitalization. Contents: Study of qualitative and quantitative analysis methods, including chromatography, spectroscopy, and titration. Review of regulatory documents and standards governing quality control of raw materials and finished products. Development of practical skills in documentation preparation to ensure reliability of analytical processes and compliance with environmental regulations.	BD	UC	5	LO 1 LO2 LO10
33	**Physico-chemical methods of analysis**	Purpose: To acquaint students with physico-chemical analysis methods for assessing the quality of pharmaceutical products, the implementation of modern technologies and regulatory requirements, as well as to develop skills in documentation preparation and ensuring manufacturing processes comply with modern standards and legislation. Contents: Study of fundamental physico-chemical analysis methods such as spectroscopy, chromatography, and titrimetry. Review of	BD	UC	3	LO 1 LO2 LO10

		quality standards, raw material and product control procedures, and regulatory-technical documents. Mastering methods for developing and updating internal documentation to ensure quality and compliance in production.				
34	**Fundamentals of project activity and team building**	Purpose: To develop students' knowledge and skills in project activities and team building in the pharmaceutical industry, taking into account social, environmental, and legislative aspects. To foster critical thinking, digital communication, and self-development abilities to enhance the effectiveness of production and research work. Contents: Study of project management fundamentals, team work methods, and intercultural interaction. Review of regulatory and technical documentation of the Russian Federation and Kazakhstan, analysis of techno-economic production indicators. Mastering digital technologies for professional communication and time management, developing skills in critical thinking and continuous self-education.	BD	UC	3	LO1 LO2 LO9 LO11 LO12
35	**Organization of the environmental management system at pharmaceutical enterprises***	Purpose: To provide students with knowledge about environmental aspects in pharmaceutical production, and to understand the importance of sustainable development and environmental protection. To develop environmental management skills in pharmaceutical enterprises using digital technologies to ensure the safety of production activities. Contents: Environmental management of pharmaceutical enterprises: the enterprise's environmental policy, environmental protection programs, and principles of their implementation. Studying the impact of the main factors of pharmaceutical production on the environment and methods of minimizing the negative impact. Mastering the principles of organizing a monitoring and control system, taking into account the regulatory requirements for environmental protection.	BD	UC	3	LO 5 LO12
36	**Fundamentals of Microbiology and Virology***	Purpose: To provide students with basic knowledge about the morphology, physiology, and classification of microorganisms and viruses, their role in the environment and human life, as well as the	BD	UC		LO 5 LO12

		principles of interaction between the microbiota and the human body, and methods of combating pathogenic forms. To teach the basics of microbiological and virological research, sanitary and hygienic assessment, and measures to prevent infectious diseases. Contents: Study of the structure, classification, and physiological characteristics of microorganisms and viruses, their role in nature and the human body. Mastering the mechanisms of pathogenicity, transmission routes of infections, and methods of diagnosis and prevention of infectious diseases. Special attention is given to the fundamentals of immunology, the interaction of microorganisms with the host organism, and modern methods of microbiological and virological control.				
37	**Fundamentals of pharmacology***	Purpose: To provide students with fundamental knowledge about the principles of drug action, their classification, pharmacokinetics, and pharmacodynamics, as well as to develop the skills of rational use of medications for effective and safe treatment in professional activities. Contents: Mastering the basic principles of the effect of medicinal substances on the body, their classification, pharmacokinetics and pharmacodynamics. The mechanisms of action, indications and contraindications for use, as well as side effects and interactions of medicinal agents are considered. Special attention is paid to the rational and safe use of medicines in clinical practice.	BD	UC		LO 5 LO12
38	**Biopharmaceuticals***	Purpose: To provide students with systematic knowledge about the principles of drug development, production, and evaluation, taking into account their biopharmaceutical properties, as well as to teach them methods for improving the effectiveness and safety of drugs during their creation and use. Contents: Study of the influence of physical, chemical and biological factors on the behavior of dosage forms in the body, including the	BD	UC		LO 5 LO12

		processes of absorption, distribution, metabolism and excretion (pharmacokinetics). Methods of development and evaluation of medicinal products are considered in order to increase their effectiveness and safety, as well as the principles of biopharmaceutical classification.				
39	**Biotechnology***	Purpose: To provide students with fundamental knowledge and practical skills in the field of biotechnology, including methods of genetic engineering, cell and microorganism cultivation, and the use of biotechnological processes for the development of products in medicine, industry, and agriculture. Contents: Mastering the basic methods and principles of biotechnology, including cell and microorganism cultivation, genetic engineering, and bioreactors. The course covers biotechnological processes used in medicine, agriculture, and industry, as well as modern technologies for developing bioproducts and their practical significance.	BD	UC		LO 5 LO12
40	**Applied mechanics***	Purpose: To provide students with solid theoretical knowledge and practical skills in the fundamentals of mechanics, including kinematics, dynamics, and statics, necessary for analyzing and solving engineering problems related to the motion and equilibrium of mechanical systems in professional activities. Contents: Study of the fundamental principles of mechanics, including the sections of kinematics, dynamics, and statics of a material point and a rigid body. The laws of motion, equilibrium, and interaction of bodies are studied, as well as methods for calculating mechanical systems. Special attention is paid to the practical application of theoretical knowledge to solve engineering problems in mechanical engineering and other technical fields.	BD	UC		LO 5 LO12
41	**Biological**	Purpose: To provide students with systematic knowledge about the chemical composition, structure, and functions of biological molecules,	BD	UC		LO 5 LO12

	chemistry*	as well as to teach them the basics of chemical processes occurring in living organisms, which are necessary for understanding the biochemical foundations of life and applying this knowledge in their professional activities. Contents: Study of the chemical composition, structure, and functions of the main biomolecules — proteins, carbohydrates, lipids, and nucleic acids. Chemical processes occurring in living organisms are considered, including enzymatic reactions, energy metabolism, and regulation of biochemical pathways. Special attention is given to the relationship between chemical processes and physiological functions, as well as the mechanisms for maintaining homeostasis in the body.				
	Profile Disciplines –PD University Component (UC)/ Elective Component(EC)				**50**	
1	**Chemical Technology of Pharmaceutical Substances and Vitamins.**	Purpose: To develop students' knowledge and skills in the chemical technology of pharmaceutical substances and vitamins, as well as the ability to enhance production efficiency and quality control at all stages — from raw materials to finished products. Contents: Study of synthesis and production processes of pharmaceutical substances and vitamins, methods of purification and quality control. Regulatory documents ensuring product quality and safety, as well as the techno-economic indicators of production processes, are considered. Students acquire skills in developing documentation for quality control and equipment maintenance..	PD	UC	**7**	LO 9 LO10
2	**Modeling of chemical engineering processes**	Purpose: To develop students' skills in modeling chemical-technological processes using digital technologies and artificial intelligence, as well as the ability to design innovative projects and business plans to enhance production efficiency, ensure quality control, and maintain the safety of technological systems. Contents: Study of methods for modeling chemical-technological	PD	UC	3	LO8 LO 9 LO10

		processes, implementation of digital solutions and AI elements in design. Topics include increasing efficiency, developing regulatory documentation, quality control of raw materials and finished products, automation, and equipment maintenance to optimize technological processes.				
3	**Metrological support of pharmaceutical industries**	Purpose: To develop students' competencies in metrological support of pharmaceutical production using digital technologies and elements of artificial intelligence, aimed at improving measurement accuracy, quality control, and the development of regulatory documentation, as well as scientifically based management of production processes. Contents: Study of metrological control methods and equipment calibration in pharmaceutical enterprises. Mastery of the development and updating of regulatory and technical documentation in the field of metrology. Application of digital platforms and AI to ensure measurement accuracy, analyze technical and economic indicators, and enhance production efficiency. Practical skills in preparing scientifically based projects and presenting innovative solutions.	PD	UC	3	LO 8 LO 9 LO10
4	**"Organization of Production and Quality Management Systems in Pharmaceuticals: GMP, GDP, ISO, GCP, and GLP"**	Purpose: To provide students with systematic knowledge and practical skills in the organization of production and management of quality management systems in the pharmaceutical industry, taking into account international standards such as GMP, GDP, ISO (9001, 14001), GCP, and GLP, which ensure the high quality, safety, and effectiveness of medicines at all stages of their development, production, distribution, and research. Contents: Students will learn about the specific features of the organization of production, distribution, and quality control of medicines, the requirements for documentation, risk management, and the environmental and clinical aspects of quality assurance. Special attention is paid to the integration of quality management systems and modern approaches to ensuring the safety and effectiveness of pharmaceutical products.	PD	UC	3	LO 8 LO 9 LO10

5	**Technology of finished dosage forms-1**	Purpose: To train students in modern technologies of drug manufacturing, development of quality control skills, process automation, and compliance with regulatory requirements to improve the efficiency and safety of finished pharmaceutical products. Contents: Study of drug manufacturing technologies, quality control of raw materials and finished products, process automation, regulatory requirements, and development of technical documentation to ensure production quality and efficiency.	PD	UC	3	LO 9 LO10
6	**Technology of finished dosage forms-2**	Purpose: To develop students' knowledge and skills in the technology of manufacturing finished pharmaceutical products, including process optimization methods, quality control, and the development of regulatory documentation. Students should be able to enhance production efficiency and ensure compliance with current pharmaceutical industry standards. Contents: The course covers technologies for manufacturing various dosage forms, technical and economic indicators, quality control methods for raw materials and finished products. It includes aspects of internal documentation development, equipment maintenance, and process automation. Emphasis is also placed on analyzing production performance and implementing innovative solutions to improve efficiency.	PD	UC	4	LO 9 LO10
7	**Technology of pharmaceutical dosage forms for industrial production***	Purpose: To master modern methods of development, production, and control of dosage forms, ensuring product quality and safety. To develop skills in analyzing technical and economic indicators to improve the efficiency of technological processes. Contents: The course includes the study of dosage form production technologies, regulatory requirements, quality control of raw materials and finished products, equipment maintenance, and process automation. It covers the development of regulatory documentation, analysis of production performance, and implementation of innovative solutions for process optimization. It also includes the study of	PD	EC	6	LO 9 LO10

		technology and equipment used in the production of various pharmaceutical dosage forms.				
8	**Industrial Drug Technology***	Purpose: To master industrial drug production technologies, develop skills in analyzing technical and economic indicators, and ensure product quality through the development of regulatory documentation and the implementation of innovative solutions. Contents: The course includes the study of drug production technologies, quality control of raw materials and finished products, development of internal documentation, equipment maintenance and process automation, and analysis of production indicators to improve efficiency. Classification of dosage forms and biopharmaceutics as an integral part of pharmaceutical technology are also studied.	PD	EC		LO 9 LO10
9	**Control systems for chemical and technological processes**	Purpose: To master management systems for chemical-technological processes, develop skills in creating scientifically based projects and business plans using digital technologies and artificial intelligence, and enhance the efficiency of production and research activities through the analysis of technical and economic indicators. Contents: The course includes studying the principles of managing chemical-technological processes, applying elements of artificial intelligence and digital technologies, developing and defending projects and business plans, analyzing technical and economic indicators, fostering critical thinking in the context of social and cultural processes, and applying language competencies for intercultural communication.	PD	UC	3	LO 8 LO 9 LO11
10	**Fundamentals of industrial safety in pharmaceutical industries**	Purpose: To provide knowledge and skills for organizing industrial safety in pharmaceutical production using intelligent monitoring systems and digital technologies, as well as to develop abilities in analyzing technical and economic indicators and creating innovative projects to enhance process safety and efficiency. Contents: The course includes studying the principles of industrial safety and inclusion, systems of equipment monitoring and digital	PD	UC	3	LO 5 LO 8 LO 9 LO12

		control, regulatory requirements, risk management methods, development of projects with elements of artificial intelligence, analysis of technical and economic indicators, and self-development to improve production safety and efficiency.				
11	**Undergraduate practice** (Research work)	Purpose: To consolidate students' knowledge and practical skills in the preparation of pharmaceutical and medical products in accordance with GMP requirements at each specific site/department. Contents: Justification of the operating principles of main apparatuses and machines used in the technological process of manufacturing finished dosage forms (FDF). Consolidation of skills in conducting patent searches when working with reference and scientific literature during the collection of necessary theoretical material for the diploma project on the approved topic.	PD	UC	6	LO 1 LO 2 LO 3 LO 4 LO 5 LO 6 LO 7 LO 8 LO 9 LO 10 LO 11 LO 12
12	**Total attestation, writing and defence of diploma projects** (Preparation for the defense and defense of the final qualifying work)	Purpose: To demonstrate the application of theoretical knowledge and practical skills in independent work by addressing relevant issues in the diploma project related to the creation of new or improvement of existing production facilities for manufacturing specific products with a given capacity. Contents: Demonstration of skills in solving complex engineering and technical problems considering modern advancements and showcasing calculation and graphic skills. Evaluation of the graduate's readiness to perform professional tasks according to the educational program standards.	PD	UC	9	LO 1 LO 2 LO 3 LO 4 LO 5 LO 6 LO 7 LO 8 LO 9 LO 10 LO 11 LO 12
		In all			**240**	
