ONTUSTIK QAZAQSTAN
MEDISINA
AKADEMIASY
«Оңтүстік Қазақстан медицина академиясы» АҚ

SKMA

SOUTH KAZAKHSTAN
MEDICAL
ACADEMY
АО «Южно-Казахстанская медицинская академия»

APPROVED
Rector of JSC "YUKMA",
Seitzhanova Zh.S.
" 31 " 03 2025

EDUCATIONAL PROGRAM

Educational Program Group:	**B072 "Pharmaceutical production technology"**
The code of the educational program:	**6B07201**
Name of the educational program:	**"Pharmaceutical Production Technology "**
The level of the educational program:	**Bachelor's Degree**

The educational program 6B07201 "Pharmaceutical Production Technology" was 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 04.02. 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	
2	Code and classification of area of education	**6B07 Engineering, manufacturing and construction 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 "Industrial and manufacturing branhes"** 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	Aim of the educational program	**Preparation of specialists for the industrial production of medicinal facilities and medical products in accordance with the requirements of GMP in Republic of Kazakhstan**

8	Level on International standard classification of education Уровень по МСКО	**0720**
9	Level on the National scope of qualifications	**6**
10	Level on the branch scope of qualifications	**6**
11	Distinctive features of the educational program	**No**
	Institution-partner (Joint educational program)	**No**
	Institution-partner (Twodiploma educational program)	**No**
12	List of competenses	**KC 1** Understanding of current trends and prospects for the development of the pharmaceutical industry and legislative aspects of the organization of production of pharmaceutical and medical products **KC 2** Knowledge of the methodology and principles of designing the production of specific pharmaceutical/medical products in accordance with the requirements of the legislation of the Republic of Kazakhstan and international standards **KC 3** Organization and implementation of the technological process of production of specific pharmaceutical/medical products in accordance with the requirements of technological regulations based on national and international standards (GMR, etc.) **KC 4** Ensuring safe conditions for the technological production process for specific pharmaceutical/medical products and making professional decisions in difficult production situations of high uncertainty **KC 5** Organizational and management activities in accordance with the production

		development strategy and ensuring the conditions for the implementation of strategic objectives to improve the quality of products **KC 6** Conducting research/experimental work to expand and update the nomenclature of pharmaceutical/medical products **KC 7** Carrying out development work on the expansion and modernization of production, on the introduction of innovative technologies, on the improvement of equipment, automation tools and control and measuring devices for monitoring the parameters of the technological process **KC 8** Regulatory and methodological support for the production of pharmaceutical/medical products to assess the compliance of technological processes with the requirements of national and international standards (GMR, etc.).
13	Results of educating	**LO 1** Demonstrates knowledge of external and internal regulatory and technical documents and acts in the conditions of technological production and in the process of updating them **LO 2** Using artificial intelligence tools and digital platforms, it Collects, processes and scientifically-based analyzes information provides critical assessment and demonstrates the ability to conduct research /experimental work on the introduction of new technologies, new equipment into production, and to expand the range of products. **LO 3** Demonstrates the ability to concentrate on improving the efficiency of work results based on the analysis of technical and economic indicators of production **LO 4** Determines the risks and causes of inconsistencies in production, offers in critical situations extraordinary solutions based on the use of production information in terms of choice and variety of methods, takes responsibility for them. **LO 5** It ensures the organization and safety of technological processes, the maintenance of technological equipment and the monitoring of the working status of automation equipment and instrumentation, monitors compliance with the documentation

		requirements in a technological process. **LO 6** Applies the laws of chemical-technological / pharmaceutical processes at a professional level to organize the technological process of production of specific pharmaceutical and medical products **LO 7** Implements the organization and management of human resources for the implementation of the technological process and solving production problems in accordance with the production strategy. **LO 8** Develops science-based projects and business plans for improving technological processes using elements of artificial intelligence and digital technologies and rguably (in writing and verbally, reports, presentations, articles) advocates the introduction of innovative technologies into production. **LO 9** Has skills for independent continuous professional self-education and effective communication in interactions with different specialists at different levels to solve production problems. **LO 10** Carries out the development of internal regulatory and technical documentation on indicators of the quality of raw materials, semi-products, finished products, maintenance of process equipment, automation equipment and instrumentation and ensures their timely updating **LO 11** Demonstrates knowledge and understanding of the issues of the pharmaceutical industry in the relationship and interdependence with other social spheres and legal requirements and understanding of current trends and prospects for the development of the pharmaceutical industry
14	Form of educating	**Internal form of educating**
15	Language of educating	Kazakh Russian
16	Common amount of credits	**240 credits**
17	Awarded academic degree	**A bachelor of technique and technology on the educational program 6B07201 -**

		"Technology of pharmaceutical production"
18	Presence of Appendix to the license to direction of preparation of specialists	**Appendix №19 from 04.04.2019 year 6B072 "Productive and processing industries" to License "Educational activity" № of KZ36LAA00011387 given out from 28.03.2018 year**
19	Presence of accreditation of the educational program	**2017 year;** **2022 year**
	Name of accreditation organ	**IQAA – Independent Agency for Quality Assurance in Education - 2017 year** **IAAR – Independent agency for accreditation and rating – 2022 year**
	Term of action of accreditation	**2017-2021 years** **2022-2027 years**
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
KC 1	+						+	+	+		+
KC 2		+	+		+			+	+	+	+
KC 3			+	+	+	+		+	+	+	
KC 4			+		+	+		+		+	+
KC 5	+	+		+			+		+		+
KC 6	+	+	+				+			+	+
KC 7	+	+	+		+	+	+	+	+		+
KC 8		+	+	+	+		+	+		+	

Application A.2

Competency/Learning Outcome Achievement Matrix

Note:
* Trajectory «Planning of pharmaceutical production»
** Trajectory «Maintenance of technological equipment»

№	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)				
1	History of Kazakhstan	Improving the efficiency of the healthcare system and improving the quality of medical services towards the formation of modern Kazakhstan. The specifics of the development of the pharmaceutical industry, civil and political confrontation, the creation of social and industrial infrastructure, the formation of a new intelligentsia, socio-political prospects for development and spiritual modernization, the construction of a New Kazakhstan.	GED	MC	5	**LO 1 LO 7 LO 11**
2	Kazakh (Russian) language	Russian and Kazakh oral and written communication skills for solving problems of interpersonal, intercultural and professional communication; information analysis in accordance with the communication situation and the ability to interpersonal social and professional communication in Kazakh and Russian languages	GED	MC	10	**LO 1 LO 7 LO 11**
3	Foreign language	Formation of skills in using language and speech tools based on a system of grammatical knowledge to build communication programs in a foreign language, self-improvement and professional success; communication in oral and written forms in a foreign language to solve problems of interpersonal, intercultural and professional communication	GED	MC	10	**LO 1 LO 7 LO 11**
4	Information and communication technology	This course covers the fundamental concepts of information and communication technologies, including computer system architecture, types of software, database systems, data analysis and management, network technologies, cy-	GED	MC	5	**LO 1 LO 7 LO 11**

		bersecurity, cloud technologies, multimedia technologies, smart technologies, fundamentals of artificial intelligence and its applications.				
5	Module of socio-political knowledge (sociology, political science, cultural studies, psychology)	Personality psychology: emotions, volitional processes, critical thinking, behavioral patterns. Sociology and political science: the individual and society, social inequality, health, politics, leadership, civil society. Cultural studies: nomadic culture, traditions and values of Kazakhstan, their influence on identity. Political culture, conflicts, world politics and international relations.	GED	MC	8	**LO 1 LO 7 LO 11**
6	Philosophy	Formation of skills in assessing the surrounding reality based on worldview positions formed by knowledge of the fundamentals of philosophy, which provide scientific understanding and study of the natural and social world by methods of scientific and philosophical knowledge; interpret the content and specific features of the mythological.	GED	MC	5	**LO 1 LO 7 LO 11**
7	Legal, financial - economic, environmental and scientific knowledge *	Purpose: to form one's own moral and civic position based on financial, economic, legal, environmental and scientific knowledge. Content: general competencies in the field of operating with social, business, cultural, legal and ethical norms of the Kazakh society for self-development and lifelong education, mobility in the modern world. The place and role of ecology in solving modern economic and political problems. Nature conservation and environmental problems of our time. Problems of ecological development. The concept of sustainable development. Regulatory and technical base of occupational safety (labor protection). Anti-corruption policy in the Republic of Kazakhstan. Legal, moral and ethical responsibility for acts of corruption in the field of public health. The choice of a business idea and a startup, business planning in the system of entrepreneurial activity, the content of the business plan, the skills of their development, start-up in marketing activities. Financial stability. Critical thinking; formation of skills in applying scientific methods and research techniques within a specific science.	GED	EC	5	**LO 1 LO 7 LO 11**
8	Fundamentals of business and principles of anticorruption cultur	Purpose: Formation of anti-corruption culture and entrepreneurship skills of the future specialist. Content: The essence and theoretical and methodological foundations of the concept of "corruption". Improvement of socio-economic relations of the Kazakh society as a condition for combating corruption. Anti-corruption policy in the Republic of Kazakhstan. Legal, moral and ethical responsibility for corruption in the field of healthcare. The choice of a business idea and a startup, business planning in the system of entrepreneurial activity, the content of the business plan, the skills of their development, start-up in marketing activities.	GED	EC		**LO 1 LO 7 LO 11**

9	Ecology, sustainable development and life safety, scientific research methods	Formation of an ecological worldview, obtaining systematic knowledge about the foundations of sustainable development of society and nature, safe human interaction with the environment; modern understanding of concepts, strategies and practical tasks of sustainable development at the national and global levels. Formation of skills in analyzing environmental processes; setting specific tasks and priorities for the sustainable development of nature and society and using the acquired knowledge to solve environmental problems. Mastering the methodological foundations of scientific knowledge. Application of scientific research methods in theory and practice	GED	EC		**LO 1 LO 7 LO 11**
10	Physical education	Formation of a person who is competitive and capable of physical self-improvement through the skills of building a personal educational trajectory throughout life for self-development and career growth, focused on a healthy lifestyle to ensure full-fledged social and professional activities through methods and means of physical culture.	GED	MC	8	**LO 1 LO 11**
		TOTAL			**56 credits**	
		Cycle of Basic Disciplines (BD) University Component (UC)				
1	Mathematics - part 1	Purpose: Formation of skills of using mathematical concepts in solving professional tasks in the workplace. Contents: Application of systems of linear algebraic equations to reflect chemical and physical processes during the preparation of LF. Application of analytical geometry in the design of pharmaceutical industries. Properties of an indefinite integral. Methods of integration of indefinite integrals, rational functions, trigonometric functions.	BD	UC	5	**LO 1 LO 7 LO 11**
2	Mathematics - part 2	Purpose: Formation of skills in the application of mathematical modeling methods in solving production problems and for engineering and economic calculations. Contents: Differential equation of the first order. Differential linear equations of the second order. Inhomogeneous second-order differential equations with constant coefficients. Probability theory and mathematical statistics in solving production problems. Statistical distribution of the sample. Mathematical modeling.	BD	UC	5	**LO 1 LO 7 LO 11**
3	General	Purpose: Formation of skills for the preparation of chemical raw materials and	BD	UC	5	**LO 1**

	chemical technology	equipment, conducting chemical processes for the production of medicinal substances. Contents: General laws of chemical processes. Economic characteristics of the chemical-technological process (CTP). The speed, the equilibrium of the CTP. Industrial catalysis. Preparation of chemical raw materials for processing. The main processes of chemical technology and equipment for them. Classification of chemical reactors. Pharmaceutical technology equipment. Chemical production as a system. CTP features.				**LO 2** **LO 3** **LO 5** **LO 6** **LO 7** **LO 11**
4	Processes and apparatuses of chemical-pharmaceutical production - 1	Purpose: Formation of skills in applying the basic laws of mechanical, hydromechanical and hydrodynamic processes when choosing equipment in pharmaceutical production. Contents: Classification and design features of machines and apparatuses for mechanical, hydromechanical and hydrodynamic processes in pharmaceutical production, types of calculations, compilation of material and energy balances, determination of the main dimensions of the devices used.	BD	UC	6	**LO 1** **LO 2** **LO 3** **LO 4** **LO 5** **LO 6** **LO 8** **LO 9** **LO 10** **LO 11**
5	Processes and apparatuses of chemical-pharmaceutical production - 2	Purpose: Formation of skills in the application of the basic laws of heat exchange, mass transfer, chemical and biochemical processes when choosing equipment in pharmaceutical production. Contents: Study of heat exchange during changes in the aggregate state of substances, compilation of material and energy balances. Classification and design features of heat exchange (evaporating, drying, condensing, etc.) apparatuses. Classification and design features of mass transfer (adsorption, sorption, extraction, crystallization, etc.) apparatuses, fundamentals of kinetic and constructive calculation of apparatuses, determination of their overall dimensions.	BD	UC	5	**LO 1** **LO 2** **LO 3** **LO 4** **LO 5** **LO 6** **LO 8** **LO 9** **LO 10** **LO 11**
6	Educational practice	Purpose: Familiarization with the general structure of a pharmaceutical enterprise, with the functions of structural units, their technical equipment, with the device and principle of operation of machines and machines for packaging and packaging of finished dosage forms and semi-finished products, as well as with the rules of their operation.	BD	UC	1	**LO 1** **LO 2** **LO 7** **LO 8**

		Contents: Familiarization with the rules of safety and industrial sanitation, work with technical and technological instructions, reference and scientific literature for the analysis of the work and calculation of the main technological equipment.				**LO 11**
7	Technology of extraction preparations	Purpose: Formation of skills in the preparation of extraction preparations from plant, animal and microbiological raw materials using primary and deep purification methods based on the use of modern technological equipment and elements of artificial intelligence. Contents: The general concept of galenic preparations. Theoretical foundations of extraction. Molecular diffusion. Convective diffusion. Features of extraction of dried and fresh raw materials. The general technology of production of tinctures, extracts, novogalenic preparations, preparations of individual substances. Features of primary and deep cleaning of the hood.	BD	UC	6	**LO 1** **LO 2** **LO 4** **LO 5** **LO 6** **LO 8** **LO 9** **LO 10** **LO 11**
8	Chemistry of natural medicinal compounds	Purpose: Formation of knowledge about the laws of chemistry of natural compounds cont4ined in medicinal plants. Contents: Classification of biologically active substances, distribution and accumulation of biologically active substances in plants. Methods of determining the structure, extraction of medicinal substances from plant sources, separation, purification and identification of biological active substances.	BD	UC	5	**LO 1** **LO 2** **LO 4** **LO 5** **LO 6** **LO 9** **LO 10** **LO 11**
9	Electrical engineering and basic of industrial electronics	Purpose: Formation of skills for solving problems of industrial electronics in the improvement of technological electrical equipment. Contents: Electrical equipment. Technical characteristics of the main electric motors (asynchronous and synchronous) used in technological complexes, the basic principles of their operation and features when combining innovative and modern technologies. Electronic and digital technologies and devices, their features and principle.	BD	UC	5	**LO 1** **LO 2** **LO 3** **LO 8** **LO 9** **LO 11**
10	Energy resources, the sources and methods of getting	Purpose: Formation of skills in finding energy sources and calculating their capacity to provide electric and thermal energy for pharmaceutical and other industries. Content: Obtaining electrical energy from alternative and traditional sources, its generation, conversion, transmission and consumption. The role of alternative energy sources in providing pharmaceutical industries; search and use of secondary energy resources as an element of waste-free production, methods and means of obtaining secondary energy resources.	BD	UC	5	**LO 1** **LO 2** **LO 3** **LO 8** **LO 9** **LO 11**
11	Manufactur-	Purpose: To study the structure and prospects for the development of the enterprise (the base	BD	UC	5	**LO 1**

	ing practice	of practice), the range of products and familiarization with activities aimed at expanding production. Content: Mastering general and special requirements on occupational health, safety and industrial sanitation. Study of the device and the principle of operation of the main devices and machines in the course of technological processes in the production of finished medicines about, mastering the rules of their operation.				**LO 2** **LO 3** **LO 5** **LO 6** **LO 7** **LO 8** **LO 11**
		TOTAL			**52 credits**	
		Cycle of Basic Disciplines (BD) **Elective Component (EC)**				
1	Physics	Purpose: Formation of skills in the application of optical, acoustic, mechanical, electrical phenomena and processes in pharmaceutical production. Contents: Kinematics and dynamics of translational and rotational motion, work and energy, conservation laws, vibrations and waves, sound and ultrasound, hydrodynamics, molecular kinetic theory, transport phenomena, direct and alternating electric current. Optical processes. Acoustic processes. Infrared rays. Ultraviolet. High-frequency alternating current.	BD	EC	5	**LO 2** **LO 6** **LO 8** **LO 9** **LO 11**
2	Descriptive geometry	Purpose: Formation of skills for performing drawing works of machine parts and mechanisms in general and in the context for understanding their application. Content: Projection methods. Deployable ruled surfaces and non-deployable surfaces. Projection drawing. Types of state standard (ГОСТ 2.305-68). Ruled surfaces. Surface determinants. Types of curves (flat, spatial). The intersection of a polyhedral surface with a straight line, a plane and with each other. Additional views. Local species. Axonometric surfaces. Incisions. Simple cuts. Cross sections.	BD	EC	4	**LO 2** **LO 9** **LO 11**
3	Applied mechanics	Purpose: Formation of skills for optimal selection of technological equipment, taking into account the principle of operation of key components and elements based on engineering calculations. Contents: Fundamentals of theoretical mechanics; axioms of statics, reduction of a system of forces to its simplest form, equilibrium conditions. Fundamentals of material resistance: concepts of strength, rigidity, stability, types of deformation. Applied mechanics: machine, mechanism. Dynamics of a material point and a solid body. Types of transmissions and connections. Criteria for designing machine parts and mechanisms.	BD	EC	5	**LO 1** **LO 2** **LO 4** **LO 5** **LO 6** **LO 9** **LO 10** **LO 11**
4	Latin language	Purpose: Formation of lexical skills in making up layouts, labels, packaging materials for drag products and medical devices.	BD	EC	3	**LO 1** **LO 9**

		Content: The role of the Latin language in the formation of pharmaceutical terminal ogy. The use of the genitive case (Genetivus) to refer to plant and animal raw materials. Names of dosage forms. Verbs and their derivatives in pharmaceutical terminology.				**LO 11**
5	Modeling of chemical and technological processes	Purpose: Formation of skills for constructing a model of the kinetics of a chemical reaction for obtaining a medicinal substance using experimental data. Contents: Mathematical methods of modeling the chemical-technological process. Tasks of optimal process management. Determining the parameters of the regression model. Building models of object statics. Identification of the dynamic characteristics of the object. Basic techniques for working with the ChemCad program.	BD	EC	6	**LO 1** **LO 2** **LO 4** **LO 5** **LO 6** **LO 8** **LO 9** **LO 11**
6	Inorganic and physical chemistry	Purpose: Formation of skills in the application of the basic laws and regularities of inorganic and physical chemistry in the production of pharmaceutical products. Contents: Regularities of the theory of solutions. The main provisions of the theory of electrolytic dissociation. The mechanism of hydrolysis reactions in electrolyte solutions. Ways to prevent hydrolysis in solutions of medicinal substances. Redox reactions in various drugs, ways to prevent them. The use of stabilizers-antioxidants.	BD	EC	4	**LO 2** **LO 4** **LO 5** **LO 6** **LO 9** **LO 11**
7	Organic chemistry	Purpose: To master important classes of organic compounds that form the basis for the formation of chemical thinking and the development of orientation in the problem of "Structure-properties". Content: The significance of classes of organic compounds in pharmaceutical production. Application of the properties of organic substances to ensure the safety of certain medicines.	BD	EC	3	**LO 2** **LO 4** **LO 5** **LO 6** **LO 9** **LO 11**
8	Analytical chemistry	Purpose: Formation of skills in the application of basic physical and chemical methods of analysis in the production of medicinal products. Contents: The essence of gravimetric analysis. Classification of separation, deposition and distillation methods. The use of titrimetric analysis to determine the composition of medicinal substances used in pharmaceutical technology. Theoretical foundations and classification of electrochemical, optical and chromatographic methods of analysis. The applied value of the general theoretical foundations of analytical chemistry	BD	EC	4	**LO 2** **LO 4** **LO 5** **LO 6** **LO 9** **LO 10** **LO 11**
9	Computing	Purpose: Formation of skills for solving economic problems using enterprise inven-	BD	EC	4	**LO 1**

	equipment on engineering and economic calculations and artificial intelligence tools	tory management models. Content: Studying the architecture of a personal computer using the AIDA64 program. Process management. Allocation of investments for the effective use of the enterprise's potential. Minimization of costs for the construction and operation of enterprises. Determination of the efficiency of the use of labor resources in queuing systems using artificial intelligence capabilities.				**LO 2** **LO 3** **LO 6** **LO 8** **LO 9** **LO 11**
10	Economics of the pharmaceutical industry and digitalization processes	Purpose: Formation of skills for analyzing the development of the pharmaceutical industry of the Republic of Kazakhstan and determining the results of economic activity of pharmaceutical enterprises. Content: Organizational and legal forms of entrepreneurial activity. Accounting and planning of fixed assets. Calculation of production costs and production costs in the pharmaceutical industry. Pricing of pharmaceutical industry enterprises. Marketing at the pharmaceutical industry enterprise. Principles and processes of digitalization in the pharmaceutical industry	BD	EC	5	**LO 1** **LO 2** **LO 3** **LO 6** **LO 7** **LO 8** **LO 9** **LO 11**
11	Methods and equipment for pharmaceutical analysis	Purpose: Formation of skills in the use of physico-chemical (instrumental) methods for pharmaceutical analysis of medicines. Contents: Principles and conditions of work on equipment (devices), sample preparation for analysis, interpretation of the results of instrumental analysis. Refractometry, polarimetry, methods based on the absorption of electromagnetic radiation: in UV spectrum, in the visible spectrum (photoelectrocolorimetry (FEC), in IR spectrum. Chromatographic methods.	BD	EC	4	**LO 1** **LO 2** **LO 4** **LO 6** **LO 9** **LO 10** **LO 11**
12	Chemistry and technology of synthetic medicinal substances	Purpose: Formation of skills in the application of industrial methods for the production of biologically active compounds of synthetic origin. Contents: Classification and nomenclature of synthetic drugs. The main directions of the search for synthetic drugs. The relationship of chemical structure with pharmacological activity. Technological scheme of production and hardware design. Pharmaceutical production control.	BD	EC	4	**LO 1** **LO 2** **LO 4** **LO 6** **LO 9** **LO 10** **LO 11**
13	Pharmaceutical biotechnology the basics of	Purpose: Formation of skills for obtaining medicines for the diagnosis, treatment and prevention of diseases based on microorganisms and culture of tissues and cells of medicinal plants. Contents: Objects of medical biotechnology. General characteristics of the biotechnological process. The use of cell culture in biotechnological production. GMP system of production and quality control of medicinal products of biotechnological production. Recombinant DNA	BD	EC	4	**LO 1** **LO 2** **LO 4** **LO 5** **LO 6**

	Microbiology	technology or genetic engineering in medical biotechnology. Biotechnology of steroid hormones, antibiotics, vitamins, amino acids.				**LO 8 LO 9 LO 10 LO 11**
14	* Fundamentals of pharmaceutical technology ********** ** Technology of therapeutic, cosmetic products	Purpose: Formation of skills in the preparation of medicines by giving them a certain dosage form. Contents: technology for the preparation of powders, liquid dosage forms (aqueous and base solutions, PPE solutions and colloidal solutions, suspensions, emulsions, drops, tinctures and decoctions), soft dosage forms (lubricants, suppositories, liniments), sterile and aseptic dosage forms (solutions for injection, eye lubricants and drops). ********** Purpose: Formation of skills in the preparation of medicinal and cosmetic products, taking into account the requirements of the GMP standard. Contents: Actual problems of creation of medical and cosmetic products State rationing of production of medical and cosmetic products, their classification and features of their industrial technology.	BD	EC	5	**LO 1 LO 2 LO 5 LO 6 LO 9 LO 10 LO 11**
		TOTAL			**60 credits**	
		Profile Disciplines (PD) University Component (UC)				
1	Industrial Drug Technology	Purpose: Formation of skills for the development of technological regulations for the industrial production of a specific drug, taking into account the requirements of regulatory documents and introduction into pharmaceutical production. Contents: Classification of finished dosage forms (drug). Industrial production of sterile LFS, taking into account the requirements of the GMP for production facilities. Industrial production of hard and soft drug, the equipment used. Biopharmaceutical as an integral part of drug technology. Pharmaceutical factors. The applied value of biopharmaceutical research.	PD	UC	6	**LO 1 LO 2 LO 4 LO 5 LO 6 LO 8 LO 9 LO 10 LO 11**
2	Fundamentals of design and equipment of	Purpose: Formation of skills for the development of projects for the production of specific medicinal and medical products in accordance with the requirements of the terms of reference.	PD	UC	6	**LO 1 LO 2 LO 4**

	pharmaceutical production	Content: Familiarization with the systems of regulatory documents in construction (СНиПы, ГОСТы, ЕСКД). Requirements for the structure and content of the project. Feasibility study of pharmaceutical production design. The general plan of pharmaceutical production. Design of production buildings for pharmaceutical enterprises in accordance with the requirements of the GMP standard and taking into account the needs of people with disabilities (inclusion). Design of production and auxiliary areas/premises. Layout/placement of technological equipment in industrial buildings.				**LO 5 LO 6 LO 8 LO 9 LO 11**
3	Control system of chemical and technological processes (automation)	Purpose: Formation of skills in the use of modern software for automatic process control systems of chemical and pharmaceutical industries. Content: Structure and functioning of the software and hardware complex of the automation system. Automatic measuring systems. Types of automatic control systems. Classification of automatic control systems. General information about industrial automatic control systems in the field of drug manufacturing technology. Mathematical models of automatic regulators.	PD	UC	6	**LO 1 LO 2 LO 4 LO 5 LO 6 LO 8 LO 9 LO 10 LO 11**
4	Undergraduate practice	Purpose: To consolidate knowledge and practical skills in the preparation of pharmaceutical and medical products in accordance with the requirements of GMR at each specific site/in a specific workshop. Content: Substantiation of the principle of operation of the main devices and machines in the course of the technological process in the production of drugs. To consolidate the skills of conducting a patent search when working with reference and scientific literature during the collection of the necessary theoretical material for the implementation of a diploma project on an approved topic.	PD	UC	6	**LO 1 LO 2 LO 3 LO 5 LO 6 LO 7 LO 8 LO 9 LO 10 LO 11**
5	Total attestation, writing and defence of diploma projects	Purpose: To demonstrate the application of theoretical knowledge and practical skills in independent work when solving topical issues of creating new/improving existing production facilities for the production of specific products with a given productivity developed in the diploma design. Content: Demonstration of skills in solving complex engineering and technical problems taking into account the achievements of progress, science and technology, as well as demonstration of computational and graphical skills.	PD	MC	**8**	**LO 1 LO 2 LO 3 LO 4 LO 5 LO 6 LO 7 LO 8**

						LO 9 LO 10 LO 11
		TOTAL			**32 credits**	
		Profile Disciplines (PD/EC) Elective Component (EC)				
1	Standardization, certification and metrology	Purpose: Formation of skills in standardization, certification and metrology using technical means for the development of domestic production, its competitiveness in national, regional and global markets. Contents: Goals, principles and methods of standardization, metrology, which is the organizational and technical basis for the production of pharmaceutical and medical products. The regulatory framework for certification of standardization and metrology facilities that ensure the quality and safety of medicines, the use of technical means, measurement and control of basic parameters of technological processes, properties of raw materials, intermediates and finished products.	PD	EC	6	**LO 2 LO 3 LO 6 LO 7 LO 11**
2	Computer Engineering Graphics in desing	Purpose: Formation of skills in the use of computer graphics in the design and preparation of drawings of technological and hardware production schemes, workshop plan and equipment layout, master plan of a pharmaceutical enterprise, etc. Content: Elements of computer graphics and their applications. The concept of CAD (computer-aided design) system. The startup dialog box of the AutoCAD system. Methods of constructing a three-dimensional model. 3D visualization. Commands for editing three-dimensional objects. Clipping a part of a three-dimensional model. Geometric drawing. Conjugations. The slope. Projection drawing.	PD	EC	5	**LO 1 LO 2 LO 6 LO 8 LO 9 LO 11**
3	Good manufacturing practices and non-waste production principles	Objective: To develop the skills of organization and management of pharmaceutical production of medicinal and medical products in accordance with the requirements of good pharmaceutical practices (GxP) and taking into account the requirements of environmental protection. Content: The concept of Good Practices in Pharmacy (GxP). The life cycle of medicines (drugs). Methodology of the quality assurance system of medicinal and medical products. Good Manufacturing Practice (GMP), basic principles. Methodological principles of waste-free/low-waste production and ways to minimize waste genera-	PD	EC	6	**LO 1 LO 2 LO 3 LO 4 LO 5 LO 6 LO 8 LO 9**

		tion, ventilation emissions, harmful sewage drains.				**LO 10** **LO 11**
4	Special technology of drugs and the basics of pharmacology	Objective: To develop skills in the field of creating separate groups of drugs (children's, geriatric, with prolonged action, with directed delivery of API to the target organ, with controlled release of API in the body), taking into account the achievements of modern pharmaceutical science. Content: Features of the technology of individual groups of drugs. Fundamentals of pharmacology. The importance of pharmacology in the process of creating new drugs. Principles of classification of medicines. The applied value of pharmacokinetic research for the industrial production of drugs.	PD	EC	5	**LO 1** **LO 2** **LO 3** **LO 6** **LO 7** **LO 8** **LO 10** **LO 11**
5	Health and safety	Purpose: Formation of safety skills at pharmaceutical enterprises for personnel and the environment in the design, construction, equipment production and operation of equipment. Contents: Legal norms, standards and requirements in the field of occupational safety and health. The requirements of the international standard ISO 45001 series and the OHSAS system for ensuring the safety of life and health of workers in pharmaceutical enterprises. Organizational and technical measures to prevent harmful and dangerous factors affecting pharmaceutical workers.	PD	EC	5	**LO 1** **LO 2** **LO 4** **LO 6** **LO 8** **LO 9** **LO 10** **LO 11**
6	Machines and automatos for filling and packaging dosage forms	Purpose: Formation of skills in choosing the optimal packaging for each specific type of pharmaceutical products and solving the problem of complex mechanization and automation of the processes of packaging and packaging of medicinal products. Contents: Basic concepts about containers and packaging. Basic requirements Standard requirements for packaging and containers for drugs, special requirements for packaging. Requirements for the external design of the packaging. Special types of packaging. The main machines and machines for packing and packing of drugs. Rationing of packaging materials.	PD	EC	6	**LO 1** **LO 2** **LO 4** **LO 5** **LO 6** **LO 8** **LO 9** **LO 10** **LO 11**
7	* Design of systems for intra-factory transportation of materials	Purpose: Formation of skills in designing systems for the transportation of materials, taking into account the requirements of GMR and the requirements of electrical engineering and electronics. Content: Goals and objectives of designing in-plant pipeline systems and equipment for transporting materials to the farm. production. Horizontal and vertical movement of liquids, gases, solid materials: pumps, compressors, conveyors, pneumatic transport, etc.	PD	EC	4	**LO 1** **LO 2** **LO 4**

	********** ** Pneumatic automation systems in pharmaceuticals	********** Purpose: Formation of skills for solving professional tasks based on the principles of building elements and systems of pneumatic automation. Contents: Purpose of pneumatic systems, conditional graphic designations of elements of pneumatic circuits, control systems for pneumatic actuators, implementation of sequential functions, pneumatic automation in pharmaceuticals: cylinders, position sensors, valves, disc valves.				**LO 5 LO 6 LO 9 LO 10 LO 11**
8	* Development of design and estimate documentation and business plan	Purpose: Formation of skills for the development, presentation and protection of a business plan based on the prepared design and estimate documentation and organizational and management plan. Content: Fundamentals of marketing and principles of studying the pharmaceutical market segment. Setting goals for SMART. Evaluation of a business idea. SWOT analysis. Preparation of design and estimate documentation. Feasibility study, calculation and analysis of projected technical and economic indicators. The main sections of the business plan. Methodology for drawing up a business plan for pharmaceutical companies. Summary of the project. Description of the product or service. Development of a financial plan.	PD	EC	5	**LO 1 LO 2 LO 3 LO 5 LO 7 LO 8 LO 9 LO 11**
	********** **Technology of dosage forms	********** Purpose: Formation of systemic knowledge and skills in the manufacture and quality control of dosage forms. Content: Basic concepts and objectives of the technology of dosage forms. Solid dosage forms, powders. Characteristic. Requirements for them. The technology of aqueous and non-aqueous solutions. IUD solutions. Suspensions and emulsions. Mild dosage forms (ointments, suppositories). Sterile and aseptically prepared dosage forms.				****** **LO 1 LO 2 LO 5 LO 6 LO 8 LO 9 LO 11**
		TOTAL			**40 credits**	
		In all			**240 credits**	

Application A3

Evaluation criteria for the LO educational program 6B07201 "Pharmaceutical Production Technology"

LO EP	Unsatisfactory	Satisfactory	Well	Great
LO 1 Demonstrates knowledge of external and internal regulatory and technical documents and acts in the conditions of technological production and in the process of updating them	Does not possess knowledge of external and internal regulatory and technical documents	Has knowledge of external and internal regulatory and technical documents	Demonstrates knowledge of external and internal regulatory and technical documents and acts in the conditions of technological production and in the process of updating them	Demonstrates in-depth knowledge of external and internal regulatory and technical documents and acts in the context of technological production and in the process of updating them
LO 2 Using artificial intelligence tools and digital platforms, it Collects, processes and scientifically-based analyzes information provides critical assessment and demonstrates the ability to conduct research /experimental work on the introduction of new technologies, new equipment into production,	It cannot collect, process, or scientifically analyze information using artificial intelligence tools and digital platforms.	It can collect, process, and scientifically analyze information using artificial intelligence tools and digital platforms.	Demonstrates the ability to carry out research/ experimental work on the introduction of new technologies and new equipment into production	Can give a critical assessment and demonstrate the ability to conduct research / experimental work on the introduction of new technologies, new equipment into production, and to expand the range of

and to expand the range of products.				products.
LO 3 Demonstrates the ability to concentrate on improving the efficiency of work results based on the analysis of technical and economic indicators of production	Does not have the information to analyze the technical and economic indicators of production	Possesses information for the analysis of technical and economic indicators of production	Demonstrates the ability to focus on improving the efficiency of work results based on the analysis of technical and economic indicators of production	Demonstrates in-depth ability to focus on improving the efficiency of work results based on the analysis of technical and economic indicators of production
LO 4 Identifies the risks and causes of nonconformities in production, suggests extraordinary solutions in critical situations based on the use of production information in conditions of choice and variety of methods, takes responsibility for them	Cannot identify the risks and causes of nonconformities in production	It can offer extraordinary solutions based on the use of production information in conditions of choice and variety of methods.	Identifies risks and causes of nonconformities in production, suggests unusual solutions based on the use of production information in critical situations.	Can take responsibility for making decisions based on the use of production information in a variety of ways.
LO 5 Ensures the organization and safety of technological processes, maintenance of technological equipment and monitoring of the working condition of automation and instrumentation, monitors compliance with documentation requirements in the conditions of the technological process	Does not have information on maintenance of technological equipment and monitoring of the working condition of automation and control and measuring devices	Possesses information on maintenance of technological equipment and monitoring of the working condition of automation and control and measuring devices	It can monitor the working condition of automation equipment and control and measuring devices, monitor compliance with documentation requirements in the conditions of the technological process.	Ensures the organization and safety of technological processes, monitors compliance with documentation requirements in the conditions of the technological process.
LO 6 Applies the laws of chemical-technological / pharmaceutical processes at a professional	Does not know the patterns of chemical and technologi-	Knows the patterns of chemical and technologi-	Demonstrates knowledge of chemical	Applies the laws of chemical and technologi-

level to organize the technological process of production of specific pharmaceutical and medical products	cal/pharmaceutical processes at a professional level for the organization of the technological production process	cal/pharmaceutical processes at a professional level for the organization of the technological process of production	and technological/pharmaceutical processes at a professional level	cal/ pharmaceutical processes at a professional level to organize the production process of specific pharmaceutical and medical products.
LO 7 Carries out the organization and management of human resources for the implementation of the technological process and the solution of production tasks in accordance with the production strategy	Does not have knowledge of the organization and management of human resources for the implementation of the technological process	Has knowledge of the organization and management of human resources for the implementation of the technological process	Demonstrates knowledge of the organization and management of human resources for the implementation of the technological process	Can implement the technological process and make decisions on production tasks in accordance with the production strategy
LO 8 Develops science-based projects and business plans for improving technological processes using elements of artificial intelligence and digital technologies and defends the introduction of innovative solutions into production in a reasoned manner (written and oral reports, presentations, articles).	Does not have information on science-based projects and a business plan for improving technological processes using elements of artificial intelligence and digital technologies	Possesses information on science-based projects and a business plan for improving technological processes using elements of artificial intelligence and digital technologies.	Develops science-based projects and business plans to improve technological processes using elements of artificial intelligence and digital technologies	He can advocate the introduction of innovative solutions into production in a reasoned manner (in writing and orally – reports, presentations, articles).
LO 9 Has the skills for independent continuous professional self-education and effective communication in interactions with different specialists at different levels to	Does not possess the skills for independent continuous professional self-education and effective communication	Possesses skills for independent continuous professional self-education and effective communication	Demonstrates skills for independent continuous professional self-education and effective communication	Solves production tasks based on skills for independent continuous professional self-education and effective communi-

solve production tasks				cation
LO 10 Carries out the development of internal regulatory and technical documentation on indicators of the quality of raw materials, semi-products, finished products, maintenance of process equipment, automation equipment and instrumentation and ensures their timely updating	Does not have knowledge of internal regulatory and technical documentation on the quality of raw materials, intermediates, finished products, and maintenance of technological equipment	Has knowledge of internal regulatory and technical documentation on the quality of raw materials, intermediates, finished products, and maintenance of technological equipment	Demonstrates knowledge of internal regulatory and technical documentation on the quality of raw materials, intermediates, finished products, and maintenance of technological equipment	It can ensure timely updating of automation and control and measuring devices based on internal regulatory and technical documentation.
LO 11 Demonstrates knowledge and understanding of the issues of the pharmaceutical industry in the relationship and interdependence with other social spheres and legal requirements and understanding of current trends and prospects for the development of the pharmaceutical industry	Has no knowledge of the pharmaceutical industry in its interrelation and interdependence with other social spheres	Has knowledge of the pharmaceutical industry in its interrelation and interdependence with other social spheres	Demonstrates knowledge and understanding of pharmaceutical industry issues in their interrelation and interdependence with other social spheres and legal requirements	Sees prospects for the development of the pharmaceutical industry based on knowledge in the pharmaceutical industry in conjunction with other social spheres