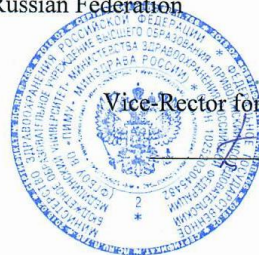


Federal State Budgetary Educational Institution of Higher Education
"Privolzhsky Research Medical University"
Ministry of Health of the Russian Federation



APPROVED

Vice-Rector for Academic Affairs

E.S. Bogomolova

31 August 2021

WORKING PROGRAM

Name of the academic discipline: PHARMACEUTICAL CHEMISTRY

Specialty: 33.05.01 Pharmacy

Qualification: Pharmacist

Department: Pharmaceutical Chemistry and Pharmacognosy

Mode of study: full-time

Labor intensity of the academic discipline: 684 academic hours

Nizhny Novgorod
2021

The working program has been developed in accordance with the Federal State Educational Standard for the specialty 33.05.01 PHARMACY, approved by order of the Ministry of Science and Higher Education of the Russian Federation on March 27, 2018 N 219.

Developers of the working program:

O.A. Vorobeva, Associate Professor of the Department, PhD;
D.S. Malygina, Associate Professor of the Department, Ph.D.

The program was reviewed and approved at the department meeting (protocol No. 1 of 08/29/2021)

Head of the Department of Pharmaceutical Chemistry
and pharmacognosy, Ph.D.



/ O.V. Zhukova /

29 August 2021

AGREED

Deputy Head of EMA ph.d. of biology _____ Lovtsova L.V.

(signature)

29 August 2021

1. The purpose and objectives of mastering the academic discipline pharmaceutical chemistry.

The purpose of mastering the discipline: *participation in forming the relevant competencies UC-1,2, GPC-1,3,6, PC-4,7.*

Tasks of the discipline:

As a result of completing the discipline, the student should

Know:

- general methods for assessing the quality of medicinal products, the possibility of using each method depending on the method of obtaining medicinal products, the raw materials, the structure of medicinal substances, and the physical and chemical processes that may occur during storage and circulation of medicinal products;

- factors affecting the quality of medicines at all stages of circulation; determination of the main factors depending on the properties of medicinal substances (redox, ability to hydrolysis, polymerization); the possibility of preventing the influence of external factors on the good quality of medicines;

- chemical methods underlying the qualitative analysis of medicines; the main structural fragments of medicinal substances, according to which the identification of inorganic and organic medicinal substances is carried out; general and specific reactions to individual cations, anions and functional groups;

- chemical methods underlying the quantitative analysis of drugs; equations of chemical reactions taking place during acid-base, redox, precipitation, complexometric titration;

- the principles underlying the physicochemical methods of drug analysis;

- equipment and reagents for chemical analysis of medicines; requirements for reagents for testing for purity, identity and quantitation; equipment and reagents for physical and chemical analysis of medicinal substances; a schematic diagram of a refractometer, photocolormeter, spectrophotometer, gas-liquid chromatography, high-performance liquid chromatography;

- the structure of regulatory documents regulating the quality of medicines; features of the structure of the pharmacopoeial article and the pharmacopoeial article of the enterprise;

- features of the analysis of individual dosage forms; concepts of disintegration, dissolution, strength; features of the analysis of soft dosage forms;

- physical and chemical constants of medicinal substances; methods for determining the melting point, rotation angle, specific absorption rate, boiling point;

- concept of validation; validation characteristics of qualitative and quantitative analysis methods;

general patterns of pharmacokinetics and pharmacodynamics of drugs; types of drug interactions and types of drug incompatibility;

- belonging of drugs to pharmacological groups, pharmacodynamics and pharmacokinetics of drugs, the most important toxic side effects, main indications and contraindications for use;

- normative documentation regulating the production and quality of medicines in pharmacies and pharmaceutical enterprises; basic requirements for dosage forms and indicators of their quality;

- nomenclature of industrial preparations;

- nomenclature of modern excipients and their properties, purpose.

Be able to:

- identify, prevent (if possible) pharmaceutical incompatibility;

- plan the analysis of medicines in accordance with their form according to regulatory documents and evaluate their quality according to the results obtained;

- prepare reagents, reference, titrated and test solutions, control them;

- to carry out the identification of medicinal substances by reactions to their structural fragments;

- determine the general indicators of the quality of medicinal substances: solubility, melting point, density, acidity and alkalinity, transparency, color, ash, weight loss upon drying;

- interpret the results of UV and IR spectrometry to confirm the identity of medicinal substances;

- use various types of chromatography in the analysis of medicinal substances and interpret its results;

- to establish the quantitative content of medicinal substances in the substance and dosage forms by titrimetric methods;

- to establish the quantitative content of medicinal substances in the substance and dosage forms by physical and chemical methods;

- carry out tests for the purity of medicinal substances and establish limits for the content of impurities by chemical and physico-chemical methods;

- perform analysis and quality control of pharmacy-made medicines in accordance with applicable requirements.

Possess:

- skills in interpreting the results of drug analysis to assess their quality; standard operating procedures for determining the order and execution of documents for the declaration of conformity of the finished product with the requirements of regulatory documents;

- skills in the use of chemical, biological, instrumental methods of analysis for the identification and determination of toxic, narcotic substances and their metabolites;

- methods of carrying out intra-pharmacy quality control of medicines;

- normative, reference and scientific literature for solving professional problems.

2. Position of the academic discipline in the structure of the General Educational Program of Higher Education (GEP HE) of the organization.

The discipline Pharmaceutical Chemistry refers to the core part (or *the part formed by the participants of educational relations*) of Block 1 of GEP HE (Academic discipline index).

The discipline is taught in 5, 6, 7, 8, 9 semesters/

2.2. The following knowledge, skills and abilities formed by previous academic disciplines are required for mastering the discipline: *mathematics, physics, general and inorganic chemistry, physical and colloid chemistry, analytical chemistry, organic chemistry, biological chemistry.*

2.3. Mastering the discipline is required for forming the following knowledge, skills and abilities for subsequent academic disciplines: *pharmacognosy, pharmaceutical technology, toxicological chemistry.*

3. Deliverables of mastering the academic discipline and metrics of competence acquisition

Mastering the discipline aims at acquiring the following universal (UC) or/and general professional (GPC) or/and professional (PC) competencies

№	Competence code	The content of the competence (or its part)	Code and name of the competence acquisition metric	As a result of mastering the discipline, the students should:		
				know	be able to	possess
1.	UC-1.	Able to realize critical analysis of problem situations based on a systematic approach, develop strategy actions	UC-1.1. Analyzes the problem situation as a system identifying its components and connections between them UC-1.2. Identifies gaps in the information needed to solve a problem situation, and designs processes for their elimination UC-1.3. Critically assesses reliability of information sources, works with conflicting information from different sources UC-1.4. Develops and meaningfully argues the strategy of solving the problem situations based on the system and interdisciplinary approaches UC-1.5. Uses logical and methodo-	<ul style="list-style-type: none"> methodology of abstract thinking for systematization of processes and construction of cause-and-effect relationships; modern theoretical and experimental methods for the implementation of own and borrowed results of scientific research into practice. 	<ul style="list-style-type: none"> abstract, analyze and synthesize the information received; highlight and to systematize the essential properties and connections of objects, to identify the main patterns of the objects under study; search, select and analyze information obtained from various sources in order to make the best decision at the modern scientific level, in accordance with professional tasks and the requirements of legal documents. 	<ul style="list-style-type: none"> methods of self-control, abstract and analytical thinking; skills in analyzing methodological problems that arise in solving research and practical problems, including those in interdisciplinary areas; skills of presenting an independent point of view

			logical tools for critical evaluation of modern concepts of philosophical and social nature in its subject areas			
2.	UC-2.	Able to manage the project at all stages of its life cycle	<p>UC-2.1. Formulates a project task on the basis of the set problems and a method of its solutions through the implementation of the project management</p> <p>UC-2.5. Monitors the progress of the project, corrects deviations, makes additional changes to the project implementation plan, clarifies zones of responsibilities of project participants</p>	principles for developing a project implementation plan in the field of professional activity at all stages of its life cycle	develop a project implementation plan in the field of professional activity at all stages of its life cycle, providing for problem situations and risks	methods of planning and executing projects under conditions of uncertainty, managing the project (supporting the implementation of the project)
3.	GPC-1.	Able to use basic biological, physical-chemical, chemical, mathematical methods for the development, research and examination of medicines, the manufacture of medicinal products	<p>GPC-1.1. Applies basic biological methods of analysis for the development, research and examination of pharmaceuticals and medicinal plant raw materials</p> <p>GPC-1.2. Applies basic physical-chemical and chemical analysis methods for the development, research and examination of medicinal products and medicinal plant raw materials</p> <p>GPC-1.3. Applies the basic methods of physical-</p>	<ul style="list-style-type: none"> •organization of a system of state control over the production and manufacture of drugs; • the main regulatory documents, production and manufacture, quality control, storage and use of medicines (domestic and international standards (GMP, GLP, GCP, GPP), pharmacopoeias, orders of the Ministry of Health of the Russian Federation, guidelines and instructions approved by the Ministry of Health of the Russian Federation) for examination using chemical, biological, physicochemical 	<ul style="list-style-type: none"> • apply chemical, biological, physico-chemical and other methods of analysis during the examination of medicines. 	<ul style="list-style-type: none"> •ensuring the process of quality control of medicines with equipment and consumables; • basic chemical, biological, physico-chemical and other methods of analysis during the examination of medicines.

			chemical analysis in the manufacture of medicinal products	and other methods; • pharmacopoeial methods of analysis used in the analysis of medicinal products using chemical, biological, physicochemical and other methods.		
			GPC-1.4. Applies mathematical methods and performs mathematical processing of data obtained during the development of medicines, as well as research and examination of medicines and medicinal plant raw materials			
	GPC-3.	Able to carry out professional activities taking into account specific economic, environmental, social factors within the framework of the system of regulations of the medicine circulation sphere	GPC-3.1. Complies with norms and rules established by the authorized state authorities when solving the tasks of professional activity in the field of medicine circulation GPC-3.3. Performs labor actions taking into account their impact on the environment, preventing the occurrence of environmental hazards	• laws and legislative acts of the Russian Federation, and methodological materials of the Ministry of Health of Russia, regulating the procedure for conducting examinations provided for in the state registration of medicines; • general principles of development, testing and registration of medicines; • the basic principles, strategies, methods and procedures for quality control of medicines in the conditions of pharmaceutical organizations used in the course of examinations provided for in the state registration of medicines, in accordance with the requirements of the current regulatory and legislative framework.	• put into practice the basic principles of the system of quality control and safety of medicines in the conditions of pharmaceutical organizations; • to organize and carry out the procedure for quality control of medicines at the level of their production, transportation and storage using methods of pharmacopoeial analysis.	• skills in organizing and conducting quality control of medicines at the level of their production, transportation and storage; • the main methods of pharmaceutical analysis provided for in the state registration of medicines; • skills in carrying out preventive measures to ensure the quality of medicines at the level of their production, transportation and storage.
	GPC-6.	Able to understand the principles of modern information technologies and	GPC-6.2. Performs an effective search for information necessary to solve	modern means of computing technology	use modern computer technology and basic office applications And	methods of practical use modern computers to search information processing and

		use them to solve the tasks of professional activity	<p>the tasks of professional activity using legal reference systems and professional pharmaceutical databases</p> <p>GPC-6.3. Uses specialized software for mathematical processing of observational and experimental data in solving problems of professional activity</p>		<p>graphic packages; evaluate way of implementing information systems and devices for solving task</p>	<p>fundamentals numerical methods for solving applied tasks</p>
PC-4.	Able to participate in monitoring the quality, effectiveness and safety of medicines and medicinal plant raw materials	<p>PC-4.1. Conducts pharmaceutical analysis of pharmaceutical substances, excipients and medicines for medical use of factory production in accordance with quality standards</p> <p>PC-4.2. Performs intra-pharmacy quality control of medicines for medical use manufactured in a pharmacy organization</p> <p>PC-4.3. Conducts pharmacognostic analysis of medicinal plant raw materials and medicinal herbal preparations</p> <p>PC-4.4. Informs in accordance with the procedure established by law about the non-compliance of the medicinal product for medical use with the established requirements or about the non-compliance of the</p>	<ul style="list-style-type: none"> • laws and legislative acts of the Russian Federation, regulatory and methodological materials of the Ministry of Health of Russia, regulating the procedure for quality control of medicines in the conditions of pharmaceutical organizations; • methods of analysis used in the quality control of drugs in the conditions of pharmaceutical organizations; • monitor drug quality assurance systems; • the process of providing equipment and consumables for quality control in the conditions of pharmaceutical organizations; 	<ul style="list-style-type: none"> • apply chemical, physico-chemical methods of intra-pharmacy quality of drugs in the conditions of pharmaceutical organizations; • draw up documentation of the established form for the control of manufactured medicinal products in the conditions of pharmaceutical organizations; • monitor drug quality assurance systems; • provide the process of quality control in pharmaceutical organizations with equipment and consumables. 	<ul style="list-style-type: none"> • basic chemical and physico-chemical methods of intra-pharmacy quality control of drugs in the conditions of pharmaceutical organizations; • registration of documentation of the established sample for the control of manufactured drugs in the conditions of pharmaceutical organizations. 	

			data on the effectiveness and safety of the medicinal product with the data on the medicinal product contained in the instructions for its use			
	PC-7.	Able to carry out operations related to the technological process in the production of medicines and their control	PC-7.5. Monitors the compliance of the raw materials and <u>excipients</u> used with the requirements of regulatory documentation	requirements of regulatory documentation for the raw materials and auxiliary materials used	carry out pharmacopoeial analysis of raw materials and auxiliary materials used	methods of quality control of raw materials and auxiliary materials used

4. Sections of the academic discipline and competencies that are formed when mastering them

p / no.	Competence code	Section name of the discipline	The content of the section in teaching units
1.	UC-1,2 GPC-1,3,6 PC-4,7	Fundamentals of Pharmaceutical Analysis	<p>Pharmaceutical chemistry as a science. The object of pharmaceutical chemistry. Methodology of pharmaceutical chemistry. The value of pharmaceutical chemistry in the preparation of a pharmacist. Tasks of pharmaceutical chemistry and ways to solve them together with chemical, biomedical and other disciplines. The place of pharmaceutical chemistry in the complex of pharmaceutical sciences.</p> <p>A brief historical outline of the development of pharmaceutical chemistry as a branch of pharmacy.</p> <p>Sources and methods for obtaining medicines: isolation from natural raw materials; reproduction of physiologically active natural substances; synthesis based on metabolites and antimetabolites; biosynthesis; use of genetic engineering; fine organic synthesis. Computer modeling and prediction of the biological activity of new compounds.</p> <p>State principles and regulations governing the quality of medicines. Regulatory documentation and standardization of medicines. State Pharmacopoeia (SP), General Pharmacopoeia Articles (GPM), Pharmacopoeia Articles (FS), Pharmacopoeia Article</p>

			<p>of the Enterprise (FSP). Legislative nature of pharmacopoeial articles. General characteristics of ND (requirements, norms and methods of control). The role of ND in improving the quality of medicines. International and regional collections of unified requirements and test methods for medicines, European Pharmacopoeia, WHO International Pharmacopoeia and other regional and national pharmacopoeias.</p> <p>Ensuring the quality of medicines. Organization of quality control of medicines. GMP rules. Quality control of medicines in production (industrial enterprises and pharmacies). Quality control of medicines during storage. The study of the expiration dates of medicines. pharmacopoeial analysis. Sampling procedure. Criteria for pharmacopoeial analysis (selectivity, sensitivity, accuracy, analysis time, amount of substance).</p> <p>Subjective and objective criteria used to determine the authenticity of a medicinal product. OFS "General reactions to authenticity".</p> <p>Chemical methods of authentication. Reactions to cations, anions, functional groups and their use for the qualitative analysis of drugs.</p> <p>Establishing the authenticity of medicines by physical constants (melting point, solidification point, boiling point). Determination of solubility, degree of whiteness, density and viscosity of drugs.</p> <p>Establishing the authenticity of medicines using instrumental methods (polarimetry, UV and IR spectroscopy, GLC and HPLC, atomic absorption spectroscopy, mass spectroscopy).</p> <p>Test methods for purity. Possible reasons for the appearance of impurities, their nature and character. Unification and standardization of tests. Techniques for determining the content of impurities based on the degree of sensitivity of chemical reactions (reference and non-reference methods).</p> <p>Methods for quantitative and semi-quantitative assessment of the content of impurities. Development of requirements for drug purity testing. Quantitative determination of impurities (chemical, physical, physico-chemical methods).</p> <p>Methods for quantitative analysis of drugs. Prerequisites for choosing a method that allows to</p>
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			<p>assess the content of the drug by functional groups that characterize its properties. Features of the quantitative analysis of pharmaceutical substances and drugs. Validation of analytical methods.</p> <p>Weight analysis (gravimetry).</p> <p>Method of acid-base titration in aqueous and non-aqueous media, complexometry, argentometry, bromatometry, iodometry, nitritometry.</p> <p>Determination of nitrogen in organic compounds.</p> <p>Optical methods: UV and IR spectrophotometry, NMR spectroscopy, photometry in the visible region of the spectrum, refractometry, polarimetry. Methods based on the emission of radiation: flame photometry, fluorimetry.</p> <p>Chromatographic methods: TLC, gas-liquid chromatography (GLC) and high performance liquid chromatography (HPLC), electrophoresis.</p> <p>Modern trends in the development of pharmaceutical analysis.</p>
2.	UC-1,2 GPC-1,3,6 PC-4,7	Inorganic medicines	<p>Classification of medicinal products of inorganic compounds. Comparative assessment of quality requirements.</p> <p>Medicinal products of elements of group VII of the periodic system of elements. Iodine. Potassium and sodium chlorides, bromides, iodides. sodium fluoride.</p> <p>Hydrochloric acid.</p> <p>Medicinal products of elements VI, V and IV of groups of the periodic system of elements. Oxygen.</p> <p>Purified water, water for injections. Hydrogen peroxide solution, hydroperite (urea peroxide).</p> <p>Sodium thiosulfate, sodium metabisulphite. Sodium bicarbonate, lithium carbonate, talc.</p> <p>Medicines of elements of groups II and III of the periodic table of elements. Barium sulfate for fluoroscopy. Calcium chloride, calcium sulfate.</p> <p>Magnesium oxide, magnesium sulfate. Aluminum hydroxide, aluminum phosphate. Boric acid, sodium tetraborate.</p> <p>Medicines of bismuth, silver, copper, zinc. Bismuth nitrate basic. Zinc oxide, zinc sulfate. Silver nitrate, collargol (colloidal silver), protargol (silver proteinate). copper sulfate.</p> <p>Iron(II) compounds. Iron(II) sulfate. Complex compounds of iron (III) and platinum (IV). Maltofer, cisplatin.</p>

			<p>radiopharmaceuticals. Prerequisites for the use of radioactive substances for diagnostic and therapeutic purposes. Features of standardization of radiopharmaceuticals. Sodium o-iodine hippurate.</p>
3.	<p>UC-1,2 GPC-1,3,6 PC-4,7</p>	<p>Medicinal products of aliphatic and alicyclic structure.</p>	<p>Halogen derivatives of hydrocarbons. Chloroethyl, halothane (halothane). Alcohols, aldehydes and ethers. Ethyl alcohol, glycerol (glycerin), polyethylene glycol, nitroglycerin, diethyl ether (medical ether and ether for anesthesia), formaldehyde solution. Carbohydrates (mono- and polysaccharides). Glucose, sucrose, lactose, glucosamine, chondroitin sulfate, starch, hydroxyethyl starch, hyaluronic acid. Derivatives of carbohydrates as excipients. Methylcellulose, carboxymethylcellulose. Carboxylic acids and their derivatives. Sodium acetate, calcium lactate, calcium gluconate, sodium citrate, sodium valproate, meldonium (mildronate), sorbic acid. Derivatives of uronic acids. Alginic acid. Lactones of unsaturated polyhydroxycarboxylic acids. Ascorbic acid. Amino acids and their derivatives. Glutamic acid, aminocaproic acid, gamma-aminobutyric acid (aminalon), methionine, cysteine, acetylcysteine, aspartame. Derivatives of polyaminopolycarboxylic acids. Tetacalcin-calcium (calcium sodium edetate). Piracetam, phenotropil as analogues of gamma-aminobutyric acid lactam. Proline derivatives: captopril, enalapril, lisinopril.</p>
4.	<p>UC-1,2 GPC-1,3,6 PC-4,7</p>	<p>Terpenes and steroids.</p>	<p>Monocyclic terpenes: menthol, validol, terpinhydrate. Bicyclic terpenes: camphor, sulphocamphoric acid and its novocaine salt (sulfocamphocaine). Diterpenes: retinols and their derivatives (group A vitamins) as medicinal and prophylactic agents. Statins. Lovastatin, simvastatin. Derivatives of cyclopentanperhydrophenanthrene. Cyclohexanoethylenehydrindane compounds. Calciferols (group D vitamins) as sterol conversion products. The mechanism of formation of vitamins ergocalciferol (D2) and cholecalciferol (D3). Cardenolides (cardiac glycosides). Structure and classification. Standardization. Biological and</p>

			<p>physico-chemical methods for quantitative assessment of the activity of cardiac glycosides.</p> <p>Stability.</p> <p>Digitalis glycosides: digitoxin, digoxin.</p> <p>A number of strophanthidine: strophanthin K, preparations of lily of the valley.</p> <p>Corticosteroids. Mineral corticosteroids: Desoxycortone acetate (deoxycorticosterone acetate). Glucocorticosteroids: cortisone acetate, prednisolone, hydrocortisone acetate, dexamethasone, fluocinolone acetonide (sinaflan).</p> <p>Gestagens and their synthetic analogues. Progesterone, norethisterone, medroxyprogesterone acetate.</p> <p>Androgens. Testosterone propionate, methyltestosterone.</p> <p>Anabolic steroids: methandienone (methandrostenolone), methandriol (methylandrostenediol), nandrolone phenylpropionate (phenobolin), nandrolone decanoate (retabolil),</p> <p>Antiandrogens: Cyproterone acetate (Androcur).</p> <p>Estrogens. Estrone and estradiol as medicinal substances.</p> <p>Prerequisites for obtaining derivatives: ethinylestradiol, estradiol esters.</p> <p>Antiestrogens: tamoxifen, anastrozole (arimidex).</p> <p>Non-steroidal estrogen analogues: hexestrol (sinestrol), diethylstilbestrol.</p>
5.	UC-1,2 GPC-1,3,6 PC-4,7	Aromatic drugs	<p>Phenols, quinones and their derivatives.</p> <p>Medicines of the phenol group: phenol, thymol, resorcinol, etamsylate, guaifenesin.</p> <p>Derivatives of naphthoquinones (group K vitamins): sodium menadione bisulfite (Vikasol).</p> <p>Aminophenol derivatives.</p> <p>Derivatives of n-aminophenol: paracetamol.</p> <p>Derivatives of m-aminophenol: neostigmine methyl sulfate (prozerin).</p> <p>Aromatic acids and their derivatives. Benzoic acid, sodium benzoate. Salicylic acid, sodium salicylate.</p> <p>Derivatives of p-hydroxybenzoic acid. Ethyl parahydroxybenzoate.</p> <p>Esters of salicylic acid. Acetylsalicylic acid.</p> <p>Derivatives of phenylpropionic acid. ibuprofen, ketoprofen.</p> <p>Derivatives of phenylacetic acid. Diclofenac sodium.</p>

			<p>Derivatives of butyrophenone. Haloperidol. aromatic amino acids.</p> <p>Derivatives of p-aminobenzoic acid: benzocaine (anesthesin), procaine hydrochloride (novocaine hydrochloride), tetracaine hydrochloride (dicaine).</p> <p>Diethylaminoacetanilides: trimecaine hydrochloride, lidocaine hydrochloride.</p> <p>Local anesthetics similar in structure: bupivacaine, articaine hydrochloride (ultracaine).</p> <p>Derivatives of p-aminobenzoic acid amide: procainamide hydrochloride (novocainamide), metoclopramide hydrochloride.</p> <p>Derivatives of p-aminosalicylic acid: sodium p-aminosalicylate.</p> <p>Derivatives of m-aminobenzoic acid: amidotrizoic acid and its sodium and N-methylglucamine salts (Triombrast for injections).</p> <p>Arylalkylamines and their derivatives. Biochemical prerequisites for obtaining medicinal substances in the series of phenylalkylamines. Ephedrine hydrochloride. Dopamine (dopamine). Epinephrine (adrenaline) and norepinephrine (norepinephrine), their salts. Isoprenaline hydrochloride, fenoterol, salbutamol, verapamil.</p> <p>Derivatives of hydroxyphenylaliphatic amino acids: levodopa, methyldopa.</p> <p>Derivatives of substituted aryloxypropanolamines (β-blockers): propranolol hydrochloride (anaprilin), atenolol, timolol, bisoprolol, fluoxetine.</p> <p>Aminodibromophenylalkylamines: bromhexine hydrochloride, ambroxol hydrochloride.</p> <p>Iodized derivatives of aromatic amino acids. Liothyronine (triiodothyronine), levothyroxine (thyroxine). Complex drug - thyroidin.</p> <p>Amides of benzenesulfonic acid. Sulfanilamide (streptocide).</p> <p>Sulfonamides substituted at the amide group (aliphatic and heterocyclic series): sodium sulfacetamide, co-trimoxazole, sulfadimethoxine, sulfalene.</p> <p>Sulfonamides substituted at the amide and aromatic amino groups. Phthalylsulfathiazole (phthalazol), salazopyridazine.</p> <p>Benzenesulfonic acid amide derivatives: furosemide, hydrochlorothiazide (dichlorothiazide, hypothiazide),</p>
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			<p>bumetanide.</p> <p>Derivatives of benzenesulfochloramide: chloramine B, halazon (pantocid).</p> <p>Derivatives of amides of sulfonic acids (substituted sulfonylurea) as antidiabetic agents. Carbutamide (Bucarban), glipizide (Minidiab), glibenclamide, gliclazide (Predian), gliquidone (Glurenorm).</p> <p>Non-aromatic antidiabetic drugs - biguanides: Metformin.</p>
6.	UC-1,2 GPC-1,3,6 PC-4,7	Antibiotics	<p>Classification by action, chemical classification. quality requirements. Activity unit. Biological, chemical and physico-chemical methods of quality assessment. Standard samples of antibiotics.</p> <p>Beta lactamides.</p> <p>Penicillins. General characteristics and structure. Relationship between structure and biological action. Penicillins of natural origin: benzylpenicillin and preparations based on it, phenoxymethylpenicillin. Targeted semi-synthesis based on 6-aminopenicillanic acid (6-APA).</p> <p>Semi-synthetic penicillins: oxacillin sodium salt, ampicillin, carbenicillin disodium salt, amoxicillin.</p> <p>Beta-lactamase inhibitors: sulbactam, clavulanic acid. Combined preparations of penicillins: amoxiclav.</p> <p>Cephalosporins. Methods for obtaining cephalosporins based on 7-aminocephalosporanic acid.</p> <p>I generation cephalosporins: cephalexin, cefazolin.</p> <p>II generation cephalosporins: cefaclor, cefuroxime.</p> <p>III generation cephalosporins: ceftizoxime, cefotaxime.</p> <p>6th generation cephalosporins: cefmetazole, cefoxitim.</p> <p>Aminoglycoside antibiotics: streptomycin sulfate, kanamycin sulfate, gentamicin sulfate, amikacin.</p> <p>Derivatives of tetrahydropyrrole. Lincomycins: lincomycin hydrochloride, clindamycin.</p> <p>Macrolides and azalides: erythromycin, azithromycin.</p> <p>Tetracyclines. Tetracycline hydrochloride, oxytetracycline hydrochloride.</p> <p>Semi-synthetic analogues: doxycycline, metacycline.</p> <p>Aromatic nitro derivatives: chloramphenicol (levomycetin) - an aromatic antibiotic and its esters (stearate and succinate). Nimesulide.</p>
7.	UC-1,2	Medicinal	Derivatives of 5-nitrofurantoin. Nitrofurantoin, furagin,

<p>GPC-1,3,6 PC-4,7</p>	<p>products of heterocyclic structure.</p>	<p>nifuratel, nifuroxazide (enterofuril). Furan derivatives. Amiodarone, griseofulvin. Benzopyran derivatives. Chromane compounds as medicinal and prophylactic agents (group E vitamins - tocopherols). Tocopherol acetate. Benzo-gamma-pyrone derivatives: Cromoglycic acid (sodium cromoglycate). Phenylchromane compounds are flavonoids (group P vitamins). Rutoside (rutin), quercetin, dihydroquercetin, diosmin. Derivatives of pyrrole (vitamins of group B12). Cyanocobalamin, hydroxocobalamin, cobamamide. Derivatives of pyrrolizidine. Platifillina hydrotartrate, povidone (polyvinylpyrrolidone). Pyrazole derivatives. Phenazone (antipyrine), metamizole sodium (analgin), phenylbutazone (butadione), propyphenazone. indole derivatives. Reserpine, indomethacin, arbidol, vinpocetine. Ergoline derivatives (ergot alkaloids and their derivatives): nicergoline, ergometrine, ergotamine, methylergometrine, bromocriptine. imidazole derivatives. Pilocarpine hydrochloride, bendazole hydrochloride (dibazole), clonidine hydrochloride (clopheline), metronidazole, naphazoline nitrate (naphthyzine), clotrimazole, omeprazole and its S-isomer - esomeprazole (nexium), afobazole, domperidone (motilium), xylometazoline (galazolin). Histamine dihydrochloride. Antihistamines: diphenhydramine hydrochloride (diphenhydramine), chloropyramine, ranitidine, famotidine. 1,2,4-triazole derivatives: fluconazole (Diflucan). Piperidine derivatives: trihexyphenidyl hydrochloride (cyclodol), ketotifen, loratadine, loperamide hydrochloride. Derivatives of dihydropyridine: nifedipine, amlodipine, nicardipine. Derivatives of pyridine-3-carboxylic acid: nicotinic acid, nicotinamide, nikethamide (nicotinic acid diethylamide), sodium salt of N-nicotinoyl-gamma-aminobutyric acid (picamilon), betahistine. Pyridine-4-carboxylic acid derivatives: isoniazid,</p>
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			<p>ftivazid, prothionamide, ethionamide.</p> <p>Pyridinemethanol derivatives. Pyridoxine hydrochloride (B6 vitamins), pyridoxal phosphate, ethylmethylhydroxypyridine (emoxipin).</p> <p>Tropane derivatives.</p> <p>Tropane alkaloids and their synthetic analogues. Atropine sulfate, scopolamine hydrochloride, homatropine hydrobromide, tropacin, etc.</p> <p>Derivatives of quinoline and isoquinoline. Derivatives of 4-substituted quinoline. Quinine, quinidine and their salts. Chloroquine phosphate (Chingamine), Hydroxychloroquine sulfate (Plaquenil).</p> <p>Derivatives of 8-hydroxyquinoline: nitroxoline (5-NOC), chlorquinaldol.</p> <p>Fluoroquinolones: lomefloxacin, ofloxacin, ciprofloxacin.</p> <p>Benzylisoquinoline derivatives. Papaverine hydrochloride and its synthetic analogue - drotaverine hydrochloride.</p> <p>Derivatives of phenanthrenisoquinoline. Morphine, codeine and their salts.</p> <p>Derivatives of morphine. Apomorphine hydrochloride, ethylmorphine hydrochloride, glaucine hydrochloride.</p> <p>Synthetic analogues of morphine. Trimeperidine hydrochloride (promedol), tramadol hydrochloride, fentanyl.</p> <p>Piperazine derivatives - cinnarizine.</p> <p>Pyrimidine derivatives.</p> <p>Derivatives of pyrimidine-2,4,6-trione (barbituric and thiobarbituric acids). Phenobarbital, thiopental sodium, benzonal (benzobarbital), hexobarbital sodium (hexenal).</p> <p>Derivatives of pyrimidine-2,4-dione. Methyluracil, fluorouracil. Nucleosides: tegafur (ftorafur), zidovudine (azidothymidine), stavudine.</p> <p>Pyrimidine-4,6-dione derivatives: primidone (hexamidine).</p> <p>Hydantoin derivatives. Phenytoin (difenin).</p> <p>Purine derivatives.</p> <p>The value of antimetabolites in the development of new drugs.</p> <p>Xanthine derivatives: caffeine, theophylline, theobromine, caffeine-sodium benzoate,</p>
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			<p>aminophylline (eufillin), diprophylline, xanthinol nicotinate, pentoxifylline.</p> <p>Guanine derivatives. Acyclovir (Zovirax), Ganciclovir (Cymeven).</p> <p>Other purine derivatives: inosine (riboxin), allopurinol, mercaptopurine, azathioprine.</p> <p>Derivatives of pteridine and isoalloxazine.</p> <p>A group of folic acid derivatives. Folic acid and its analogues. Methotrexate.</p> <p>Derivatives of isoalloxazine (vitamin B2). Riboflavin, riboflavin mononucleotide.</p> <p>Derivatives of phenothiazine. Alkylamino derivatives: chlorpromazine hydrochloride (chlorpromazine), levomepromazine, trifluoperazine dihydrochloride (triftazine), fluphenazine decanoate, etc.</p> <p>Acyl derivatives: ethacizine, moracizine hydrochloride (ethmozine).</p> <p>Derivatives of benzodiazepines. Chlordiazepoxide, diazepam (sibazon), medazepam, nitrazepam, phenazepam, alprazolam, etc.</p> <p>Dibenzodiazepine derivatives: clozapine (azaleptin).</p> <p>Derivatives of 1,2-benzothiazine: piroxicam.</p> <p>Derivatives of 10,11-dihydrodibenzocycloheptene: amitriptyline.</p> <p>Derivatives of 1,5-benzothiazepine: diltiazem.</p> <p>Derivatives of iminostilbene: carbamazepine.</p> <p>Pyrimidinothiazole derivatives. Vitamins of group B1. Thiamine chloride and bromide, phosphothiamin, cocarboxylase, benfotiamine.</p>
8.	UC-1,2 GPC-1,3,6 PC-4,7	Metrological foundations of pharmaceutical analysis. Validation evaluation of analysis methods	<p>Basics of metrology. Basic concepts. Metrological characteristics of the analysis results.</p> <p>Statistical processing of analysis results in accordance with the requirements of the Global Fund.</p> <p>Types of analysis error. Errors in the analysis of physicochemical and chemical methods. Methods for identifying systematic and random errors.</p> <p>Validation evaluation of analysis methods. Validation characteristics of the main types of methods.</p> <p>Establishment of the specificity of methods of qualitative and quantitative analysis, determination of foreign impurities. Linearity. Precision. Accuracy and correctness of analysis methods. Limit of detection and quantification. robustness.</p>
9.	UC-1,2	Standardization	Legislation of the Russian Federation regulating the

		discipline							
1	5	Fundamentals of Pharmaceutical Analysis	2	-	44	-	-	18	64
2	5	Inorganic medicines	10	-	30	-	-	18	58
3	5	Medicinal products of aliphatic and alicyclic structure.	10	-	32	-	-	30	72
4	6	Terpenes and steroids.	6	-	11	-	-	18	35
5	6	Aromatic drugs	8	-	31	-	-	42	81
6	7	Antibiotics	9	-	28	-	-	30	67
7	7.8	Medicinal products of heterocyclic structure.	29	-	74	-	-	66	169
8	9	Metrological foundations of pharmaceutical analysis. Validation evaluation of analysis methods	4	-	24	-	-	18	46
9	9	Standardization and quality control of medicines. Declaring the quality of medicines	14	-	24	-	-	18	56
		TOTAL	92		298			258	648

* - L – lectures; LP – laboratory practicum; P – practicals; S – seminars; SIW – student’s individual work.

6.2. Thematic schedule of educational work types:

6.2.1 Thematic schedule of lectures

No. p / p	Name of lecture topics	Volume in AH				
		5	6	7	8	9
1.	Pharmaceutical chemistry as a science.	2				
2.	<i>Medicinal products of elements VI, V and IV of groups of the periodic system of elements.</i> Oxygen. Purified water, water for injections. Hydrogen peroxide solution, hydroperite (urea peroxide). Sodium thiosulfate, sodium metabisulphite. Sodium bicarbonate, lithium carbonate, talc.	2				
3.	<i>Medicinal products of elements of group VII of the periodic system of elements.</i> Iodine. Potassium and sodium chlorides, bromides, iodides. sodium fluoride. Hydrochloric acid.	2				
4.	<i>radiopharmaceuticals.</i> Prerequisites for the use of radioactive substances for diagnostic and therapeutic purposes. Features of standardization of radiopharmaceuticals. Sodium o-iodine hippurate.	2				
5.	<i>Medicines of elements of groups II and III of the periodic table of elements.</i> Barium sulfate for fluoroscopy. Calcium chloride, calcium sulfate. Magnesium oxide, magnesium sulfate. Aluminum hydroxide, aluminum phosphate.	2				

	Boric acid, sodium tetraborate.					
6.	<p><i>Medicines of bismuth, silver, copper, zinc.</i> Bismuth nitrate basic. Zinc oxide, zinc sulfate. Silver nitrate, collargol (colloidal silver), protargol (silver proteinate). copper sulfate.</p> <p><i>Iron(II) compounds.</i> Iron(II) sulfate. Complex compounds of iron (III) and platinum (IV). Maltofer, cisplatin.</p>	2				
7.	<p>Organic medicines. Classification, nomenclature. Sources and methods of obtaining. Analysis methods.</p> <p><i>Halogen derivatives of hydrocarbons.</i> Chloroethyl, halothane (halothane).</p>	1				
8.	<p><i>Alcohols, aldehydes and esters.</i> Ethyl alcohol, glycerol (glycerin), polyethylene glycol, nitroglycerin, diethyl ether (medical ether and ether for anesthesia), formaldehyde solution.</p>	2				
9.	<p><i>Carboxylic acids and their derivatives.</i> Sodium acetate, calcium lactate, calcium gluconate, sodium citrate, sodium valproate, meldonium (mildronate), sorbic acid.</p>	2				
10.	<p><i>Derivatives of uronic acids.</i> Alginate acid.</p> <p><i>Lactones of unsaturated polyhydroxycarboxylic acids.</i> Ascorbic acid.</p>	2				
11.	<p><i>Amino acids and their derivatives.</i> Glutamic acid, aminocaproic acid, gamma-aminobutyric acid (aminalon), methionine, cysteine, acetylcysteine, aspartame.</p> <p><i>Derivatives of polyaminopolycarboxylic acids.</i> Tetacalcin-calcium (calcium sodium edetate).</p> <p>Piracetam, phenotropil as analogues of gamma-aminobutyric acid lactam.</p> <p><i>Proline derivatives:</i> captopril, enalapril, lisinopril.</p>	3				
12.	<p><i>Monocyclic terpenes:</i> menthol, validol, terpinhydrate.</p> <p><i>Bicyclic terpenes:</i> camphor, sulphocamphoric acid and its novocaine salt (sulfocamphocaine).</p> <p><i>Diterpenes:</i> retinols and their derivatives (group A vitamins) as medicinal and prophylactic agents.</p> <p><i>Statins.</i> Lovastatin, simvastatin.</p>		2			
13.	<p><i>Derivatives of cyclopentanperhydrophenanthrene.</i></p> <p><i>Cyclohexanoethylenehydrindane compounds.</i> Calciferols (group D vitamins) as sterol conversion products. The mechanism of formation of vitamins ergocalciferol (D2) and</p>		1			

	cholecalciferol (D3).					
14.	<p><i>Corticosteroids.</i> <i>Mineral</i> <i>corticosteroids:</i>Desoxycortone acetate (deoxycorticosterone acetate). <i>Glucocorticosteroids:</i>cortisone acetate, prednisolone, hydrocortisone acetate, dexamethasone, flucinolone acetonide (sinaflan).</p>		1			
15.	<p><i>Gestagens and their synthetic analogues.</i> Progesterone, norethisterone, medroxyprogesterone acetate. <i>Androgens.</i>Testosterone propionate, methyltestosterone. <i>Anabolic steroid:</i>Methandienone (Methandrostenolone), Methandriol (Methylandrostenediol), Nandrolone Phenylpropionate (Phenobolin), Nandrolone Decanoate (Retabolyl), <i>Antiandrogens:</i>cyproterone acetate (Androcur).</p>		1			
16.	<p><i>Estrogens.</i>Estrone and estradiol as medicinal substances. Prerequisites for obtaining derivatives: ethinylestradiol, estradiol esters. <i>Antiestrogens:</i>tamoxifen, anastrozole (arimidex). <i>Non-steroidal estrogen analogues:</i> hexestrol (sinestrol), diethylstilbestrol.</p>		1			
17.	<p>aromatic compounds. General information about the dependence of the chemical structure and biological action in a number of aromatic compounds. Sources and methods of obtaining. General and private methods of analysis. <i>Phenols, quinones and their derivatives.</i> <i>Medicines of the phenol group:</i> phenol, thymol, resorcinol, etamsylate, guaifenesin. <i>Derivatives of naphthoquinones (vitamins of</i> <i>group K):</i>menadione sodium bisulfite (Vikasol) <i>Aminophenol derivatives.</i> <i>Derivatives of n-aminophenol:</i> paracetamol. <i>m-aminophenol derivatives:</i> neostigmine methyl sulfate (prozerin).</p>		1			
18.	<p><i>Aromatic acids and their derivatives.</i>Benzoic acid, sodium benzoate. Salicylic acid, sodium salicylate. <i>Derivatives of p-hydroxybenzoic acid.</i> Ethyl parahydroxybenzoate. <i>Esters of salicylic acid.</i>Acetylsalicylic acid. <i>Phenylpropionic acid derivatives.</i> ibuprofen, ketoprofen. <i>Derivatives of phenylacetic acid.</i>Diclofenac</p>		1			

	sodium. <i>Derivatives of butyrophenone.</i> Haloperidol.					
19.	<i>aromatic amino acids.</i> <i>Derivatives of p-aminobenzoic acid:</i> benzocaine (anesthesin), procaine hydrochloride (novocaine hydrochloride), tetracaine hydrochloride (dicaine). Diethylaminoacetanilides: trimecaine hydrochloride, lidocaine hydrochloride. <i>Structurally related local anesthetics:</i> bupivacaine, articaine hydrochloride (ultracaine).		2			
20.	<i>Derivatives of p-aminobenzoic acid amide:</i> procainamide hydrochloride (novocainamide), metoclopramide hydrochloride. <i>Derivatives of p-aminosalicylic acid:</i> sodium p-aminosalicylate. <i>Derivatives of m-aminobenzoic acid:</i> amidotrizoic acid and its sodium and N-methylglucamine salts (Triombrast for injection).		1			
21.	<i>Arylalkylamines and their derivatives.</i> Biochemical prerequisites for obtaining medicinal substances in the series of phenylalkylamines. Ephedrine hydrochloride. Dopamine (dopamine). Epinephrine (adrenaline) and norepinephrine (norepinephrine), their salts. Isoprenaline hydrochloride, fenoterol, salbutamol, verapamil.		1			
22.	<i>Derivatives of hydroxyphenyl-aliphatic amino acids:</i> levodopa, methyl dopa. <i>Derivatives of substituted aryloxypropanolamines (β-blockers):</i> propranolol hydrochloride (anaprilin), atenolol, timolol, bisoprolol, fluoxetine. <i>Aromatic nitro derivatives:</i> chloramphenicol (levomycetin) is an aromatic antibiotic and its esters (stearate and succinate). Nimesulide. <i>Aminodibromophenylalkylamines:</i> bromhexine hydrochloride, ambroxol hydrochloride. <i>Iodized derivatives of aromatic amino acids.</i> Liothyronine (triiodothyronine), levothyroxine (thyroxine). Complex drug - thyroidin.		2			
23.	<i>Antibiotics.</i> Classification by action, chemical classification. quality requirements. Activity unit. Biological, chemical and physico-chemical methods of quality assessment. Standard samples of antibiotics.			2		
24.	<i>Beta lactamides.</i> <i>Penicillins.</i> General characteristics and			2		

	<p>structure. Relationship between structure and biological action.</p> <p><i>Penicillins of natural origin:</i> benzylpenicillin and drugs based on it, phenoxymethylpenicillin.</p> <p>Targeted semi-synthesis based on 6-aminopenicillanic acid (6-APA).</p> <p><i>Semi-synthetic penicillins:</i> oxacillin sodium salt, ampicillin, carbenicillin disodium salt, amoxicillin.</p> <p><i>Beta-lactamase inhibitors:</i> sulbactam, clavulanic acid.</p> <p><i>Combined preparations of penicillins:</i> amoxiclav.</p>					
25.	<p><i>Cephalosporins.</i> Methods for obtaining cephalosporins based on 7-aminocephalosporanic acid.</p> <p><i>Ist generation cephalosporins:</i> cephalexin, cefazolin.</p> <p><i>II generation cephalosporins:</i> cefaclor, cefuroxime.</p> <p><i>Third generation cephalosporins:</i> ceftizoxime, cefotaxime.</p> <p><i>6th generation cephalosporins:</i> cefmetazole, cefoxitim.</p>			2		
26.	<p><i>Aminoglycoside antibiotics:</i> streptomycin sulfate, kanamycin sulfate, gentamicin sulfate, amikacin.</p> <p><i>Derivatives of tetrahydropyrrole.</i> Lincomycins: lincomycin hydrochloride, clindamycin.</p>			2		
27.	<p><i>macrolides and azalides:</i> erythromycin, azithromycin.</p>			1		
28.	<p>Heterocyclic compounds of natural and synthetic origin. Study of natural biologically active compounds of heterocyclic structure as one of the ways to create new medicinal substances. Classification of heterocyclic compounds. Application of general physical and chemical patterns in the formation of requirements for the quality of medicinal substances and the choice of analysis methods. oxygen-containing heterocycles.</p> <p><i>Derivatives of 5-nitrofur.</i> Nitrofur, furagin, nifuratel, nifuroxazide (enterofuril).</p> <p><i>Furan derivatives.</i> Amiodarone, griseofulvin.</p>			1		
29.	<p><i>Benzopyran derivatives.</i></p> <p><i>Chromine compounds</i> as medicinal and prophylactic agents (group E vitamins - tocopherols). Tocopherol acetate.</p> <p><i>Benzo-gamma-pyrone derivatives:</i> Cromoglycic acid (sodium cromoglycate)</p>			1		
30.	<p><i>Phenylchromane compounds-</i> flavonoids (vitamins of the P group). Rutoside (rutin),</p>			1		

	quercetin, dihydroquercetin, diosmin.					
31.	nitrogen-containing heterocycles. <i>Pyrrrole derivatives</i> (vitamins B12). Cyanocobalamin, hydroxocobalamin, cobamamide. <i>Derivatives of pyrrolizidine</i> .Platifillina hydrotartrate, povidone (polyvinylpyrrolidone). <i>Pyrazole derivatives</i> . Phenazone (antipyrine), metamizole sodium (analgin), phenylbutazone (butadione), propyphenazone.			3		
32.	<i>indole derivatives</i> . Reserpine, indomethacin, arbidol, vinpocetine. <i>Ergoline derivatives</i> (ergot alkaloids and their derivatives): nicergoline, ergometrine, ergotamine, methylergometrine, bromocriptine.			2		
33.	<i>imidazole derivatives</i> .Pilocarpine hydrochloride, bendazole hydrochloride (dibazole), clonidine hydrochloride (clophelin), metronidazole, naphazoline nitrate (naphthyzine), clotrimazole, omeprazole and its S-isomer - esomeprazole (nexium), domperidone (motilium), xylometazoline (galazolin), afobazole. Histamine dihydrochloride. <i>Antihistamines</i> :diphenhydramine hydrochloride (diphenhydramine), chloropyramine, ranitidine, famotidine.			3		
34.	<i>Piperidine derivatives</i> : trihexyphenidyl hydrochloride (cyclodol), ketotifen, loratadine, loperamide hydrochloride. <i>Derivatives of dihydropyridine</i> : nifedipine, amlodipine, nicardipine.				1	
35.	<i>Derivatives of pyridine-3-carboxylic acid</i> :nicotinic acid, nicotinamide, nikethamide (nicotinic acid diethylamide), N-nicotinoyl- gamma-aminobutyric acid sodium salt (picamilon), betahistine.				1	
36.	<i>Derivatives of pyridine-4-carboxylic acid</i> :isoniazid, ftivazid, protionamide, ethionamide. <i>Pyridinemethanol derivatives</i> . Pyridoxine hydrochloride (B6 vitamins), pyridoxal phosphate, ethylmethylhydroxypyridine (emoxipin).				1	
37.	<i>Tropane derivatives</i> . <i>Tropane alkaloids and their synthetic analogues</i> .Atropine sulfate, scopolamine hydrochloride, homatropine hydrobromide, tropacin, etc.				1	
38.	<i>Derivatives of quinoline and isoquinoline</i> . <i>Derivatives of 4-substituted quinoline</i> . Quinine, quinidine and their salts. Chloroquine				1	

	phosphate (Chingamine), Hydroxychloroquine sulfate (Plaquenil). <i>8-hydroxyquinoline derivatives</i> : nitroxoline (5-NOC), chlorquinaldol.					
39.	<i>Fluoroquinolones</i> : lomefloxacin, ofloxacin, ciprofloxacin. <i>Benzylisoquinoline derivatives</i> . Papaverine hydrochloride and its synthetic analogue - drotaverine hydrochloride				1	
40.	Phenantrenisoquinoline derivatives and their synthetic analogues. <i>Derivatives of phenanthrenisoquinoline</i> . Morphine, codeine and their salts. <i>Morphine derivatives</i> . Apomorphine hydrochloride, ethylmorphine hydrochloride, glaucine hydrochloride. <i>Synthetic analogues of morphine</i> . Trimeperidine hydrochloride (promedol), tramadol hydrochloride, fentanyl.				2	
41.	<i>Piperazine derivatives</i> - cinnarizine. <i>Pyrimidine derivatives</i> . <i>Derivatives of pyrimidine-2,4,6-trione (barbituric and thiobarbituric acids)</i> . Phenobarbital, thiopental sodium, benzonal (benzobarbital), hexobarbital sodium (hexenal).				1	
42.	<i>Pyrimidine-2,4-dione derivatives</i> . Methyluracil, fluorouracil. Nucleosides: tegafur (ftorafur), zidovudine (azidothymidine), stavudine. <i>Pyrimidine-4,6-dione derivatives</i> : primidone (hexamidine). <i>Hydantoin derivatives</i> . Phenytoin (difenin).				1	
43.	<i>Pyrimidinothiazole derivatives</i> . Vitamins of group B1. Thiamine chloride and bromide, phosphothiamin, cocarboxylase, benfotiamine.				1	
44.	<i>Purine derivatives</i> . The value of antimetabolites in the development of new drugs. <i>xanthine derivatives</i> : caffeine, theophylline, theobromine, sodium caffeine benzoate, aminophylline (euphylline), diprophylline, xanthinol nicotinate, pentoxifylline.				1	
45.	<i>Guanine derivatives</i> . Acyclovir (Zovirax), Ganciclovir (Cymeven). <i>Other Purine Derivatives</i> : inosine (riboxin), allopurinol, mercaptopurine, azathioprine.				2	
46.	Derivatives of pteridine and isalloxazine. <i>A group of folic acid derivatives</i> . Folic acid and its analogues. Methotrexate. <i>Isalloxazine derivatives</i> (vitamin B2). Riboflavin, riboflavin mononucleotide.				1	

47.	<i>Derivatives of phenothiazine. Alkylamino derivatives:</i> chlorpromazine hydrochloride (chlorpromazine), levomepromazine, trifluoperazine dihydrochloride (triftazine), fluphenazine decanoate, etc. <i>Acyl derivatives:</i> ethacizine, moracizine hydrochloride (ethmozine).				1	
48.	<i>benzodiazepine derivatives.</i> Chlordiazepoxide, diazepam (sibazon), medazepam, oxazepam, nitrazepam, phenazepam, alprazolam, etc. <i>Dibenzodiazepine derivatives:</i> clozapine (azaleptin).				1	
49.	<i>1,2-benzothiazine derivatives:</i> piroxicam. Derivatives of 10,11-dihydrodibenzocycloheptene: amitriptyline. <i>Derivatives of 1,5-benzothiazepine:</i> diltiazem. Derivatives of iminostilbene: carbamazepine.				1	
50.	Types of analysis error. Errors in the analysis of physicochemical and chemical methods. Methods for identifying systematic and random errors.					4
51.	Validation evaluation of analysis methods. Validation characteristics of the main types of methods. Establishment of the specificity of methods of qualitative and quantitative analysis, determination of foreign impurities. Linearity. Precision. Accuracy and correctness of analysis methods. Limit of detection and quantification. robustness.					2
52.	Organization of quality control of medicines. GMP rules. Quality control of medicines in production (industrial enterprises and pharmacies). Declaration of quality of medicines.					6
53.	Quality control of medicines during storage. The study of the expiration dates of medicines.					6
TOTAL (total 129 Ah)		22	14	20	18	18

6.2.2. Thematic plan of practicals

No. p / p	Name of topics of practical classes	Volume in AH				
		5	6	7	8	9
1.	Introductory lesson. Goals and objectives of the laboratory workshop. Safety precautions in the chemical laboratory.	2				
2.	RD for medicines. General methods of pharmacopoeial analysis. Work with the methodical manual.	8				
3.	Determination of the quality of medicinal substances by appearance, color, transparency and degree of turbidity, solubility.	8				

	Determination of weight loss on drying. Tablet disintegration test.					
4.	Determination of the authenticity of inorganic medicinal substances.	4				
5.	Determination of impurities of inorganic ions in medicinal substances. Standard and non-standard methods for the determination of impurities. Solution of situational problems.	4				
6.	Preparation of reagents, indicators, buffer solutions. Solution of situational problems.	4				
7.	Preparation of titrated solutions. Solution of situational problems.	4				
8.	Analysis of purified water, water for injection, water for injection in ampoules.	4				
9.	Colloquium on the topic "General and private methods for determining the quality of medicines"	4				
10.	Application of argentometry in the pharmaceutical analysis of halogen-containing medicinal substances of inorganic nature.	4				
11.	The use of permanganometry in the pharmaceutical analysis of drugs of compounds of elements of groups VI and V of the periodic system D.I. Mendeleev.	4				
12.	Acid-base titration method in pharmaceutical analysis. Pharmacopoeial analysis of LP compounds of elements of group III of the periodic system D.I. Mendeleev.	4				
13.	Application of complexometry in pharmaceutical analysis. Pharmacopoeial analysis of drugs of compounds of elements of groups V and II of the periodic system D.I. Mendeleev.	4				
14.	Colloquium on the topic "Application of argentometry, permanganometry, complexometry, acid-base titration methods in pharmaceutical analysis. Compounds I-III and V-VII of PS groups.	4				
15.	Control work on practical skills. Solution of situational problems. Final testing.	4				
16.	Final coursework.	4				
17.	Qualitative analysis of organic medicinal substances by functional groups. Pharmacopoeial analysis of medicinal substances of alcohols and their derivatives".		4			
18.	Analysis of medicinal substances, derivatives of aldehydes.		4			
19.	Pharmacopoeial analysis of ether preparations.		4			
20.	Analysis of lactones of unsaturated polyhydroxycarboxylic acids: Ascorbic acid.		4			
21.	Pharmacopoeial analysis of salts of carboxylic		4			

	acids. Tablet analysis. GF requirements for the quality of tablets.					
22.	Pharmacopoeial analysis of aliphatic amino acid preparations.		4			
23.	Pharmacopoeial analysis of ester preparations.		4			
24.	Practical control work on the analysis of organic drugs of the aliphatic series. Test control by section.		4			
25.	Analysis of medicinal products of terpene derivatives. Solution of situational problems.		4			
26.	Control work "Analysis of drugs of a steroid structure." Solution of situational problems. Test control by section.		4			
27.	Pharmacopoeial analysis of drugs from the group of phenols. Solution of situational problems.		4			
28.	Pharmacopoeial analysis of drugs derived from aromatic acids. Solution of situational problems.		4			
29.	Pharmacopoeial analysis of drugs derived from aromatic amino acids.		4			
30.	Control work "Analysis of drugs of phenols, aromatic acids and aromatic amino acids." Solution of situational problems. Test control by section.		4			
31.	Analysis of organic medicinal substances by functional groups.		4			
32.	Pharmacopoeial analysis of organic medicinal substances: benzenesulfonamides and their derivatives.		4			
33.	Solution of situational problems on pharmacopoeial methods of analysis.		2			
34.	Final control work "Medicines of aliphatic and alicyclic structure" and "Medicines of aromatic structure". Control work on practical skills.		4			
35.	Analysis of dosage forms of industrial and pharmaceutical production. The use of chemical and physico-chemical methods for the analysis of dosage forms.			9		
36.	Educational and research work of students (UIRS). Theoretical substantiation of methods of analysis and experimental work on the analysis of dosage forms of industrial and pharmaceutical production			5		
37.	Pharmacopoeial analysis of antibiotics of the β -lactamide group. Solution of situational problems.			5		
38.	Pharmacopoeial analysis of antibiotics - aminoglycosides and antibiotics of the tetracycline group. Solution of situational problems.			5		
39.	Pharmacopoeial analysis of			5		

	nitrophenylalkylamine derivatives (levomycetin). Solution of situational problems.					
40.	Educational and research work of students (UIRS). Theoretical substantiation of methods of analysis and experimental work on the analysis of dosage forms containing antibiotics.			5		
41.	Test work and seminar on the pharmacopoeial analysis of antibiotics. Test control by section.			5		
42.	Analysis of drugs derived from furan. Solution of situational problems.			5		
43.	Analysis of drugs derived from benzopyran and pyrrole. Solution of situational problems.			5		
44.	Analysis of drugs of pyrazole derivatives. Solution of situational problems.			5		
45.	Analysis of medicinal products of imidazole and benzimidazole derivatives. Solution of situational problems.			5		
46.	Test work on the topic: Medicines derivatives of five-membered heterocycles. Test control.			5		
47.	Analysis of medicinal products of pyridine-3-carboxylic acid derivatives. Solution of situational problems.				3	
48.	Analysis of drugs of pyridine-4-carboxylic acid derivatives. Solution of situational problems.				3	
49.	Test work and seminar "Alkaloids, tropane derivatives, and their synthetic analogues." Test control by section.				2	
50.	Analysis of medicinal products of quinoline derivatives.				4	
51.	Analysis of drugs derived from isoquinoline and benzyloisoquinoline				4	
52.	Control work and seminar "Analysis of medicines of quinoline and isoquinoline". Solution of situational problems. Test control by section.				2	
53.	Pharmacopoeial analysis of medicinal substances of pyrimidine derivatives (barbiturates, uracil derivatives).				4	
54.	Pharmacopoeial analysis of pyrimidinothiazole derivatives.				4	
55.	Control work and seminar "Analysis of drugs of pyrimidine and pyrimidinothiazole derivatives". Solution of situational problems. Test control by sections.				2	
56.	Pharmacopoeial analysis of drugs of purine derivatives.				4	
57.	Pharmacopoeial analysis of drugs of pteridine derivatives				4	
58.	Pharmacopoeial analysis of drugs derived from isoalloxazine.				4	
59.	Pharmacopoeial analysis of drugs of				4	

	benzodiazepine derivatives.					
60.	Test work and seminar "Analysis of medicinal products of phenothiazine derivatives". Solution of situational problems. Test control by section.				2	
61.	Types of analysis error. Errors in the analysis of physicochemical and chemical methods. Methods for identifying systematic and random errors.					10
62.	Statistical processing of pharmaceutical analysis methods.					10
63.	Quality control of medicines during storage. The study of the expiration dates of medicines.					10
64.	Incompatibility of medicinal substances and methods for its elimination.					10
65.	Control work and a seminar on the section.					8
	TOTAL (total 304 AH)	70	70	64	46	48

6.2.3. Types and topics of student's individual work (SIW)

No. p / p	Types and topics of SIW	Volume in AH				
		5	6	7	8	9
1.	Working with literary and other sources of information on the section under study	10	12	12	12	5
2.	Doing homework provided by the discipline program	10	10	10	6	6
3.	Writing an abstract (essay, report, scientific article) on a given problem	-	-	-	-	20
4.	Preparing for a business game	2	4	4	4	-
5.	Working with electronic educational resources	4	6	6	6	5
6.	The study of material submitted for independent work	8	10	10	6	-
7.	Preparation for practical work	8	10	8	6	3
8.	Preparation for examinations and tests	10	8	10	4	3
	TOTAL (total 216 AH)	52	60	60	44	42

7. Types of assessment formats for ongoing monitoring and mid-term assessment

No. p / p	semester number	Types of control	Name of section of academic discipline	Competence codes	Assessment formats		
					types	number of test questions	number of test task options
1	2	3	4		5	6	7
1.	5	Control of student's independent	Fundamentals of pharmaceutical analysis.	UC-1,2 GPC-1,3,6 PC-4,7	Related Poll	3	6

		nt work					
2.	5	Control of student's independent work	Fundamentals of pharmaceutical analysis. Preparation of titrated solutions	UC-1,2 GPC-1,3,6 PC-4,7	Related Poll	4	13
3.	5	Control of student's independent work	Fundamentals of pharmaceutical analysis. Determination of impurity content and weight loss on drying	UC-1,2 GPC-1,3,6 PC-4,7	Related Poll	2	12
4.	5	Control of student's independent work.	inorganic drugs. Medicines of groups I and II of the Periodic system	UC-1,2 GPC-1,3,6 PC-4,7	Related Poll	2	6
5.	5	Control of student's independent work.	inorganic drugs. Medicines II and III groups of the Periodic system	UC-1,2 GPC-1,3,6 PC-4,7	Related Poll	3	6
6.	5	current control	inorganic drugs.	UC-1,2 GPC-1,3,6 PC-4,7	Related Poll	5	12
7.	5	Final control	inorganic drugs.	UC-1,2 GPC-1,3,6 PC-4,7	Test	240	Computer testing (option is formed by random sampling)
8.	5	Control of student's independent work.	Medicinal products of aliphatic and alicyclic structure. "Alcohols"	UC-1,2 GPC-1,3,6 PC-4,7	Related Poll	3	12
9.	5	current control	Medicinal products of aliphatic and alicyclic structure. "Alcohols and Esters"	UC-1,2 GPC-1,3,6 PC-4,7	Test	20	Computer testing (option is formed by random sampling)
10.	5	Control of student's independent work.	Medicinal products of aliphatic and alicyclic structure. "Carbohydrates and	UC-1,2 GPC-1,3,6 PC-4,7	Related Poll	3	12

			lactones"				
11.	5	current control	Medicinal products of aliphatic and alicyclic structure. "Aldehydes, carboxylic acids, lactones"	UC-1,2 GPC-1,3,6 PC-4,7	Test	40	Computer testing (option is formed by random sampling)
12.		Control of student's independent work.	Medicinal products of aliphatic and alicyclic structure.	UC-1,2 GPC-1,3,6 PC-4,7	Test	20	Computer testing (option is formed by random sampling)
13.	6	Final control	Terpenes and Steroid retinols. drugs.	UC-1,2 GPC-1,3,6 PC-4,7	Test	thirty	Computer testing (option is formed by random sampling)
14.	6	Final control	Terpenes and Steroid retinols. drugs.	UC-1,2 GPC-1,3,6 PC-4,7	Related Poll	3	13
15.	6	Control of student's independent work.	Aromatic medicines. "Phenols, quinones and their derivatives"	UC-1,2 GPC-1,3,6 PC-4,7	Test	20	Computer testing (option is formed by random sampling)
16.	6	Control of student's independent work.	Aromatic medicines. Aromatic amino acids	UC-1,2 GPC-1,3,6 PC-4,7	Related Poll	3	5
17.	6	current control	Aromatic medicines. Aromatic amino acids	UC-1,2 GPC-1,3,6 PC-4,7	Test	20	Computer testing

							(option is formed by random sampling)
18.	6	Control of student's independent work.	Aromatic medicines. "Aromatic amines".	UC-1,2 GPC-1,3,6 PC-4,7	Test	thirty	Computer testing (option is formed by random sampling)
19.	6	Control of student's independent work.	Aromatic medicines. "Arylalkylamines, nitrophenylalkylamines".	UC-1,2 GPC-1,3,6 PC-4,7	Test	20	Computer testing (option is formed by random sampling)
20.	6	Control of student's independent work.	Aromatic medicines. "sulfonamides".	UC-1,2 GPC-1,3,6 PC-4,7	Test	20	Computer testing (option is formed by random sampling)
21.	6	Final control	Aromatic medicines.	UC-1,2 GPC-1,3,6 PC-4,7	Test	50	Computer testing (option is formed by random sampling)
22.	7	Control of student's independent work.	Antibiotics. "β-lactam antibiotics"	UC-1,2 GPC-1,3,6 PC-4,7	Related Poll	3	12
23.	7	current	Antibiotics.	UC-1,2	Test	8	Comput

		control	"Analysis of derivatives of β -lactamides and aminoglycosides"	GPC-1,3,6 PC-4,7			er testing (option is formed by random sampling)
24.	7	current control	Intrapharmacy control.	UC-1,2 GPC-1,3,6 PC-4,7	Test	20	Computer testing (option is formed by random sampling)
25.	7	Final control	Antibiotics.	UC-1,2 GPC-1,3,6 PC-4,7	Test	40	Computer testing (option is formed by random sampling)
26.	7	Control of student's independent work.	Medicinal products of heterocyclic structure. "Furan derivatives"	UC-1,2 GPC-1,3,6 PC-4,7	Test	10	Computer testing (option is formed by random sampling)
27.	7	Control of student's independent work.	Medicinal products of heterocyclic structure. "Pyrazole and imidazole derivatives"	UC-1,2 GPC-1,3,6 PC-4,7	Test	25	Computer testing (option is formed by random sampling)
28.	7	current control	Medicinal products of heterocyclic structure. "Furan	UC-1,2 GPC-1,3,6 PC-4,7	Test	4	Computer testing

			derivatives"				(option is formed by random sampling)
29.	8	current control	Medicinal products of heterocyclic structure. "Derivatives of furan, benzopyran, pyrazole and imidazole"	UC-1,2 GPC-1,3,6 PC-4,7	Test	40	Computer testing (option is formed by random sampling)
30.	8	Control of student's independent work.	Heterocyclic drugs "Benzylisoquinoline and phenanthrenisoquinoline derivatives"	UC-1,2 GPC-1,3,6 PC-4,7	Test	25	Computer testing (option is formed by random sampling)
31.	8	current control	Heterocyclic drugs "Benzylisoquinoline and phenanthrenisoquinoline derivatives"	UC-1,2 GPC-1,3,6 PC-4,7	Related Poll	4	6
32.	8	Control of student's independent work.	Medicinal products of heterocyclic structure "Tropane derivatives"	UC-1,2 GPC-1,3,6 PC-4,7	Test	20	Computer testing (option is formed by random sampling)
33.		Control of student's independent work.	Medicinal products of heterocyclic structure "Quinoline derivatives"	UC-1,2 GPC-1,3,6 PC-4,7	Test	thirty	Computer testing (option is formed by random sampling)

34.	8	current control	Medicinal products of heterocyclic structure "Quinoline and tropane derivatives"	UC-1,2 GPC-1,3,6 PC-4,7	Related Poll	8	6
35.	8	current control	Medicinal products of heterocyclic structure "Pyridine, piperazine derivatives"	UC-1,2 GPC-1,3,6 PC-4,7	Test	40	Computer testing (option is formed by random sampling)
36.	8	Control of student's independent work.	Medicinal products of heterocyclic structure "Pyrimidine derivatives"	UC-1,2 GPC-1,3,6 PC-4,7	Test	20	Computer testing (option is formed by random sampling)
37.	9	Control of student's independent work.	Medicinal products of heterocyclic structure "Purine derivatives"	UC-1,2 GPC-1,3,6 PC-4,7	Test	20	Computer testing (option is formed by random sampling)
38.	9	current control	Medicinal products of heterocyclic structure "Derivatives of purine and pyrimidine"	UC-1,2 GPC-1,3,6 PC-4,7	Related Poll	6	6
39.	9	Control of student's independent work.	Metrological foundations of pharmaceutical analysis. Validation evaluation of analysis methods	UC-1,2 GPC-1,3,6 PC-4,7	business game	1	50
40.	9	current control	Incompatibility Issues	UC-1,2 GPC-1,3,6 PC-4,7	Related Poll	5	18

8. 8. Educational, methodological and informational support for mastering the academic discipline (printed, electronic publications, the Internet and other network resources)

8.1. Key literature references

No.	Name according to bibliographic requirements	Number of copies	
		At the department	In the library
1.	Huynh-Ba K. Handbook of Stability Testing in Pharmaceutical Development (Regulations, Methodologies, and Best Practices) □Electronic resource□. - Springer, 2009. - 390 p.	Electrical version	-
2.	Jouyban A. Handbook Of Solubility Data For Pharmaceuticals □Electronic resource□. - CRC Press, 2010. - 554 p.	Electrical version	-
3.	Putz M. V. (Ed.) Quantum Frontiers of Atoms and Molecules[Electronic resource]. - Nova Science Publishers, 2011. - 673 p.	Electrical version	-
4.	The British Pharmacopoeia 2012. – London: The Stationery Office on Behalf of the Medicines and Healthcare Products Regulatory Agency (MHRA) [Electronic resource].	Electrical version	-
5.	The International Pharmacopoeia. 4th Edition[Electronic resource]. - WHO Pharmacopoeia Library. 2011.	Electrical version	-
6.	The United States Pharmacopeia (USP 32) and the 27th edition of the National Formulary (NF 27) [Electronic resource]. – Washington, DC: The United States Pharmacopeial Convention. 2009. - 815 p.	Electrical version	-
7.	The Japanese Pharmacopoeia Sixteenth Edition[Electronic resource]. – Tokyo, The Committee on Japanese Pharmacopoeia, 2011. 2326 p.	Electrical version	-
8.	Pyatigorskaya N.V. and others. Rules for the organization of production and quality control of medicinal products from plant materials: textbook□Electronic resource□. - St. Petersburg: SpecLit, 2013. - 367 p.	Electrical version	-
9.	Pleteneva T.V. and others. Quality control of medicines: textbook□Electronic resource□. - M. : GEOTAR-Media, 2015. - 560 p. – Access mode: EBSStudent Advisor	Electrical version	-
10.	Order of the Ministry of Health of Russia dated October 26, 2015 N 751n "On approval of the rules for the manufacture and dispensing of drugs for medical use by pharmacy organizations, individual entrepreneurs licensed for pharmaceutical activities" □Electronic resource□	Electrical version	-

8.2. Further reading

p / no.	Name according to bibliographic requirements	Number of copies	
		in the library	at the department
1.	Belikov VG Synthetic and natural medicines : a brief guide / VG Belikov . - M.: Higher School, 1993. - 720 p.	2	-
2.	Laboratory work in pharmaceutical chemistry: Textbook / V. G. Belikov, I. Ya. Kul, G. I. Lukyanchikova, A. S. Saushkina and S. G. Tiraspol'skaya; ed. E. N. Vergeichik and E. V. Kompantseva; Ed. organization Pyatigorsk State Pharmaceutical Academy. - 2nd ed., revised. and additional .. - Pyatigorsk: B.I., 2003. (2003) - 342 p.	203	-
3.	Guide to laboratory studies in pharmaceutical chemistry : textbook / EN Aksenova and OP Andrianova ; ed. A. P. Arzamastsev. - 3rd ed., revised. and additional .. - M.: Medicine, 2004. (2004) - 384 p.	20	-
4.	State Pharmacopoeia of the USSR: Issue 1: General methods of analysis. - 11th ed. - M.: Medicine, 1987. - 336 p.	32	-
5.	State Pharmacopoeia of the USSR: Issue. 2: General methods of analysis. Medicinal plant material. - 11th ed. - M.: Medicine, 2000. - 400 p.	5	-
6.	State Pharmacopoeia of the USSR: Issue. 2. General methods of analysis. Medicinal plant materials / redol. M. D. Mashkovsky, E. A. Babayan, A. N. Oboymakova, V. M. Bulaev, and V. A. Severtsev; Ed. organization Ministry of Health of the USSR. - 11th ed. - M.: Medicine, 1990. - 400 p.	25	-
7.	State Pharmacopoeia of the USSR. - 10th ed. - M.: Medicine, 1968. - 1080 p.	1	-
8.	Glushchenko N. N. Pharmaceutical chemistry: textbook / N. N. Glushchenko, T. V. Pleteneva and V. A. Popkov. - M.: Academy, 2004. (2004) - 384 s	118	-
9.	Soldatenkov A. T. Fundamentals of organic chemistry of medicinal substances / A. T. Soldatenkov, N. M. Kolyadina and I. V. Shendrik. - 3rd ed. - M.: Mir; M.: BINOM. Knowledge Laboratory, 2007. (2007) - 191 p.	1	-
10.	Granik V.G. Fundamentals of Medical Chemistry: Textbook / V.G. Granik. - M.: Vuzovskaya kniga, 2001. (2001) - 384 p.	1	-
11.	Slesarev V.I. Chemistry. Fundamentals of Living Chemistry: A Textbook for High Schools / V.I. Slesarev. - St. Petersburg.: Himizdat, 2000. - 768 p.	1	-

8.3. Electronic educational resources for teaching academic subjects

8.3.1. Internal Electronic Library System of the University (IELSU)

Name of the electronic resource	Brief description (content)	Access conditions	Number of users
Internal Electronic Library	Proceedings of the teaching staff of the Academy:	from any computer on the Internet,	Not limited

System of the University (IELSU)	textbooks and teaching aids, monographs, collections of scientific papers, scientific articles, dissertations, abstracts of dissertations, patents.	using an individual login and password	
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8.4.2. Electronic educational resources acquired by the University

<i>No. p / p</i>	<i>Name of the electronic resource</i>	<i>Brief description (content)</i>	<i>Access conditions</i>	<i>Number of users</i>
1.	DB "Medicine. Healthcare (HPE)" (EBS "Student Consultant")	Educational literature + additional materials (audio, video, interactive materials, test tasks) for higher medical and pharmaceutical education	from any computer on the Internet, using an individual login and password	Not limited
2.	Electronic library system «BookUp»	Educational and scientific medical literature of Russian publishing houses, incl. translations of foreign publications	from university computers; from any computer on the Internet using an individual login and password Subscribed editions are available for reading.	Not limited
3.	Electronic Medical Library "Doctor's Consultant"	National guidelines in all areas of medicine, clinical guidelines, textbooks, monographs, atlases, pharmaceutical reference books, audio and video materials, ICD-10 and ATC, recent publications in foreign journals with brief annotations in Russian	from any computer on the Internet, using an individual login and password	Not limited
4.	Domestic electronic periodicals	Medical periodicals	from the university computers on the platform of the SCIENTIFIC electronic library eLIBRARY.RU Subscribed editions are available for reading.	Not limited
5.	DB Medline	Foreign full-text	from university	Not limited

	Complete	database of articles from scientific periodicals and collections of medical and natural science topics	computers; from any computer on the Internet, using an individual login and password	
6.	Springer Electronic Collection	Full-text scientific publications (journals, books, articles, scientific protocols, conference materials, etc.) in the natural sciences, medical sciences and the humanities	from university computers	Not limited
7.	Electronic collection "Freedom" on the Science Direct platform	Books and periodicals of the publishing house "Elsevier" in the natural sciences, medicine and humanities	from university computers	Not limited
8.	DB Scopus	International Science Citation Abstract Database	from university computers	Not limited
9.	DB Web of Science Core Collection	International Science Citation Abstract Database	from university computers; from any computer on the Internet, using an individual login and password	Not limited
10.	DB Questel Orbit	Questel Patent Database	from university computers	Not limited

8.4.3 Open access resources

No . p / p	Name of the electronic resource	Brief description (content)	Access conditions
1	Federal Electronic Medical Library (FEMB)	Includes electronic analogues of printed publications and original electronic publications that have no analogues recorded on other media (dissertations, abstracts, books, magazines, etc.).	from any computer on the Internet
2.	Scientific electronic library eLIBRARY.RU	The largest Russian information portal in the field of science, technology, medicine and education, containing abstracts and full texts of scientific articles and	from any computer on the Internet.

		publications.	
3.	Scientific electronic library of open access CyberLeninka	Full texts of scientific articles with annotations published in scientific journals in Russia and neighboring countries.	from any computer on the Internet
4.	Russian State Library (RSL)	Abstracts for which there are copyright agreements with permission for their open publication	from any computer on the Internet
5.	Reference and legal system "Consultant Plus"	Federal and regional legislation, judicial practice, financial advice, legislative comments, etc.	from any computer on the Internet

9. Material and technical support for mastering an academic discipline

9.1. List of premises for classroom activities for the discipline

1. Lecture room - classroom
2. Classrooms for practical classes, seminars, intermediate certification - in the same place.
3. Scientific laboratories for conducting practical exercises and laboratory workshops

9.2. List of equipment for classroom activities for the discipline

1. Multimedia complex (laptop, projector, screen)

overhead multimedia projector Vega Focus 400 GLS (101042910) – 1 pc.,

multimedia projector BenQ NB 6110 (101042596) – 1 pc.,

Notebook HP Pavilion Notebook 15-ab234ur (101341033) - 1 pc.;

Laptop ASUS Z99H (101041277) – 1 pc.;

screen - 2 pcs.

2. A set of electronic presentations on lecture topics.

3. Instruments and equipment:

spectrophotometer UNICO 1200 (101043138) – 1 pc.,

RN-meter millivoltmeter RN-150M (101043000) - 1 pc.,

Liquid chromatograph LC-10AVP (101043413) – 1 pc.,

spectrophotometer Specord S100 Bio (101043137) – 1 pc.

Fourier IR spectrophotometer IRAffinity-1S (101241054) – 1 pc.,

Rotary evaporator LEKI RE 52AA (101041294) – 1 pc.,

Scales EK-400N (101041435) - 1 pc.,

Spectrophotometer UV-1800 scanning 2-beam (101240610) - 1 pc.,

Analytical balance ATX-224 (101240947) - 1 pc.,

Infrared Fourier spectrophotometer (101040380) - 1 pc.,

Water purification system MILLIPORE Elix-3 (101041324) – 1 pc., AA-7000F atomic

absorption spectrophotometer (101340100) – 1 pc., Liquid chromatograph LC-20AD

Prominence (101240611) – 1 pc., Chromatographic column C 18 (101040683)) - 1 PC.

Computer Pentium 4 (101041937) - 1 pc.,

Printer HP LJ 1010 laser (101042738) - 1 pc.,

Refrigerator 2-chamber Atlant XM-4012-000 (101065445) - 1 pc.

Exhaust cabinet 1460*700*2100 (101260844) - 1 pc.,

Exhaust cabinet 1800*700*2100 (101260842, 101260843) - 2 pcs.,

fume hood 1460*700*2100 (101261000) – 1 pc.,

information stand (101261001 and 101260845) - 2 pcs.

information stand (101261002, 101261003) - 2 pcs.

9.3. A set of licensed and freely distributed software, including domestic production

Item no.	Software	number of licenses	Type of software	Manufacturer	Number in the unified register of Russian software	Contract No. and date
1	Wtware	100	Thin Client Operating System	Kovalev Andrey Alexandrovich	1960	2471/05-18 from 28.05.2018
2	MyOffice is Standard. A corporate user license for educational organizations, with no expiration date, with the right to receive updates for 1 year.	220	Office Application	LLC "NEW CLOUD TECHNOLOGIES"	283	without limitation, with the right to receive updates for 1 year.
3	LibreOffice		Office Application	The Document Foundation	Freely distributed software	
4	Windows 10 Education	700	Operating systems	Microsoft	Azure Dev Tools for Teaching Subscription	
5	Yandex. Browser		Browser	«Yandex»	3722	
6	Subscription to MS Office Pro for 170 PCs for FGBOU VO "PIMU" of the Ministry of Health of Russia	170	Office Application	Microsoft		23618/HN10030 LLC "Softline Trade" from 04.12.2020

10. List of changes to the working program (to be filled out by the template)

Federal State Budgetary Educational Institution of Higher Education
"Privolzhsky Research Medical University"
Ministry of Health of the Russian Federation
(FSBEI HE "PRMU" of the Ministry of Health of Russia)

Department of
Name of the department

CHANGE REGISTRATION SHEET

working program for the academic discipline
NAME OF THE ACADEMIC DISCIPLINE

Field of study / specialty / scientific specialty: _____
(code, name)

Training profile: _____
(name) - for master's degree programs

Mode of study: _____
full-time/mixed attendance mode/extramural

Position	Number and name of the program section	Contents of the changes made	Effective date of the changes	Contributor's signature
1				

Approved at the department meeting
Protocol No. _____ of _____ 20__

Head of the Department

department name, academic title

signature

print name