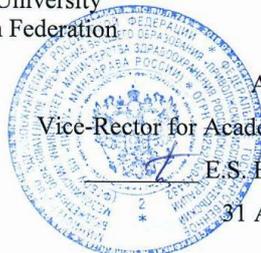


Federal State Budgetary Educational Institution of Higher Education  
"Privolzhsky Research Medical University"  
Ministry of Health of the Russian Federation



APPROVED  
Vice-Rector for Academic Affairs  
E.S. Bogomolova  
31 August 2021

### WORKING PROGRAM

Name of the academic discipline: **TOXICOLOGICAL CHEMISTRY**

Specialty: 33.05.01 Pharmacy

Qualification: **Pharmacist**

**Department: Pharmaceutical Chemistry and Pharmacognosy**

Mode of study: **full-time**

Labor intensity of the academic discipline: 216 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/

August 29, 2021

AGREED

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

(signature)

August 29, 2021

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

1.1 The purpose of mastering the discipline: participation in forming the relevant competencies UC-1,2; GPC-1,3,6; PC-4,7,12.

1.2 Discipline tasks:

As a result of completing the discipline, the student should

**Know:**

- main directions of development of chemical-toxicological analysis and activities of chemical-toxicological laboratories, centers for the treatment of poisoning, bureaus of forensic medical examination, narcological dispensaries;
- principles of quality assurance of analytical diagnostics and forensic examination;
- the main patterns of distribution and transformation of toxic substances in the human body (toxicokinetics, toxicodynamics), general characteristics of the toxic effect;
- classification of narcotic drugs, psychotropic and other toxic substances and their physical and chemical characteristics.

**Be able to:**

- independently conduct forensic chemical studies of physical evidence for various toxic substances, applying knowledge of biochemical and analytical toxicology, using a complex of modern biological, physicochemical and chemical methods of analysis;
- to carry out analytical diagnostics of acute intoxications, taking into account the peculiarities of chemical and toxicological analysis in the conditions of providing emergency medical care to patients with acute poisonings;
- carry out analytical diagnostics of narcotic drugs, psychotropic and other toxic substances in the biological environment of the human body;
- interpret the results of chemical-toxicological analysis, taking into account the processes of biotransformation of toxic substances and the possibilities of analytical research methods;
- document the conduct of laboratory and expert studies, draw up an expert opinion.

**Possess:**

- skills in the use of chemical, biological, instrumental methods of analysis for the identification and determination of toxic, narcotic substances and their metabolites;
- skills in the use of express methods of analysis for the analytical diagnosis of drug addiction, substance abuse, acute poisoning; the basic principles of documenting chemical and toxicological studies.

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

2.1. The discipline Toxicological 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 7, 8 semesters.

2.2. **The following knowledge, skills and abilities formed by previous academic disciplines are required for mastering the discipline:** *fundamentals of higher mathematics, physics, pharmacology, biological chemistry, pharmacognosy, inorganic chemistry, analytical chemistry, organic chemistry, physical chemistry, pharmaceutical chemistry*

2.3. **Mastering the discipline is required for forming the following knowledge, skills and abilities for subsequent academic disciplines:** pharmaceutical chemistry, pharmacognosy, management and economics of pharmacy.

**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	<p>UC-1.1. Analyzes the problem situation as a system identifying its components and connections between them</p> <p>UC-1.2. Identifies gaps in the information needed to solve a problem situation, and designs processes for their elimination</p> <p>UC-1.3. Critically assesses reliability of information sources, works with conflicting information from different sources</p> <p>UC-1.4. Develops and meaningfully argues the strategy of solving the problem situations based on the system and interdisciplinary approaches</p> <p>UC-1.5. Uses logical and methodological tools for critical evaluation of modern concepts of philosophical and social nature in its subject areas</p>	<ul style="list-style-type: none"> <li>methodology of abstract thinking for systematization of processes and construction of cause-and-effect relationships;</li> <li>modern theoretical and experimental methods for the implementation of own and borrowed results of scientific research into practice.</li> </ul>	<ul style="list-style-type: none"> <li>abstract, analyze and synthesize the information received;</li> <li>highlight and to systematize the essential properties and connections of objects, to identify the main patterns of the objects under study;</li> <li>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.</li> </ul>	<ul style="list-style-type: none"> <li>methods of self-control, abstract and analytical thinking;</li> <li>skills in analyzing methodological problems that arise in solving research and practical problems, including those in interdisciplinary areas;</li> <li>skills of presenting an independent point of view</li> </ul>
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-2.2. Develops a project concept within the framework of the designated problem: formulates the purpose, tasks, justifies the relevance, significance, expected results and possible areas of their application</p> <p>UC-2.3. Plans necessary resources, including taking into account their</p>	<p>principles for developing a project implementation plan in the field of professional activity at all stages of its life cycle</p>	<p>develop a project implementation plan in the field of professional activity at all stages of its life cycle, providing for problem situations and risks</p>	<p>methods of planning and executing projects under conditions of uncertainty, managing the project (supporting the implementation of the project)</p>

			<p>replaceability</p> <p>UC-2.4. Develops a project implementation plan using planning tools</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>			
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-chemical analysis in the manufacture of medicinal products</p> <p>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</p>	<ul style="list-style-type: none"> <li>• organization of a system of state control over the production and manufacture of drugs;</li> <li>• 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 and other methods;</li> <li>• pharmacopoeial methods of analysis used in the analysis of medicinal products using chemical, biological, physicochemical and other methods.</li> </ul>	<ul style="list-style-type: none"> <li>• apply chemical, biological, physicochemical and other methods of analysis during the examination of medicines.</li> </ul>	<ul style="list-style-type: none"> <li>• ensuring the process of quality control of medicines with equipment and consumables;</li> <li>• basic chemical, biological, physicochemical and other methods of analysis during the examination of medicines.</li> </ul>
4.	GPC-3.	Able to carry out professional activities taking into account specific economic,	GPC-3.1. Complies with norms and rules established by the authorized state authorities when	<ul style="list-style-type: none"> <li>• laws and legislative acts of the Russian Federation, normative and methodological materials of the Ministry of</li> </ul>	<ul style="list-style-type: none"> <li>• put into practice the basic principles of the system of quality control and safety of medicines in the conditions of</li> </ul>	<ul style="list-style-type: none"> <li>• skills in organizing and conducting quality control of medicines at the level of their production, transportation and storage;</li> </ul>

		environmental, social factors within the framework of the system of regulations of the medicine circulation sphere	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	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.	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.	• 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.
5.	GPC-6.	Able to understand the principles of modern information technologies and use them to solve the tasks of professional activity	GPC-6.2. Performs an effective search for information necessary to solve the tasks of professional activity using legal reference systems and professional pharmaceutical databases GPC-6.3. Uses specialized software for mathematical processing of observational and experimental data in solving problems of professional activity	modern means of computing technology	use modern computer technology and basic office applications And graphic packages; evaluate way of implementing information systems and devices for solving task	methods of practical use modern computers to search information processing and fundamentals numerical methods for solving applied tasks
6.	PC-4.	Able to participate in monitoring the quality, effectiveness and safety of medicines and medicinal plant	PC-4.1. Conducts pharmaceutical analysis of pharmaceutical substances, excipients and	•laws and legislative acts of the Russian Federation, regulatory and methodological materials of the Ministry of Health of	• apply chemical, physico-chemical methods of intra-pharmacy quality of drugs in the conditions of	• basic chemical and physico-chemical methods of intra-pharmacy quality control of drugs in the conditions of pharmaceutical organizations; • registration of

		raw materials	medicines for medical use of factory production in accordance with quality standards PC-4.2. Performs intra-pharmacy quality control of medicines for medical use manufactured in a pharmacy organization PC-4.3. Conducts pharmacognostic analysis of medicinal plant raw materials and medicinal herbal preparations 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 data on the effectiveness and safety of the medicinal product with the data on the medicinal product contained in the instructions for its use	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;	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.	documentation of the established sample for the control of manufactured drugs in the conditions of pharmaceutical organizations.
7.	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 excipients 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
8.	PC-12.	Able to take part in conducting	PC-12.1. Participates in conduct-	regulatory and legislative acts regulating the	• apply the regulatory framework	• apply the regulatory framework

		chemical-toxicological and forensic-chemical research in order to diagnose poisoning, drug and alcohol intoxication	ing chemical and toxicological research PC-12.2. Conducts forensic chemical studies in order to detect poisoning, drug and alcohol intoxication PC-12.3. Participates in monitoring the quality and safety of medicines and medicinal plant raw materials	examination of poisoning and intoxication; • physico-chemical methods underlying the qualitative and quantitative analysis of poisonous substances in accordance with the requirements of the State Pharmacopoei a.	governing the examination of poisoning and intoxication; • analyze poisonous substances, poisoning products, biological material in accordance with the requirements of regulatory documentation	governing the examination of poisoning and intoxication; • analyze poisonous substances, poisoning products, biological material in accordance with the requirements of regulatory documentation • skills in analyzing poisonous substances, poisoning products, biological material in accordance with the requirements of regulatory documentation
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**4. Sections of the academic discipline and competencies that are formed when mastering them**

p / no.	Competence code	Name of the discipline section	The content of the section in didactic units
1.	UC-1,2 GPC-1,3,6 PC-4,7,12	Toxicological chemistry as a special discipline. Legal basis of chemical-toxicological analysis. Detoxification methods for acute poisoning	<p>Toxicological chemistry as a special discipline. Subject and tasks of toxicological chemistry. Communication with medical (forensic medicine), biomedical, pharmaceutical disciplines, clinical toxicology, narcology. The main sections of toxicological chemistry. The main directions of its development. Forensic medicine and forensic chemistry in the 17th – 19th centuries. The emergence of toxicological chemistry from the needs of forensic medicine and toxicology. The main tasks of forensic medicine and toxicology. The first chemical schools in Russia and outstanding scientists who contributed to the development of toxicological chemistry. Forensic chemistry in Russia in the XX century. Organization of the Central Forensic Laboratory and the State Research Institute of Forensic Medicine. The main directions of development of toxicological chemistry. Toxicological chemistry in pharmaceutical education. Toxic substances as a subject of study of toxicological chemistry. Problems and tasks of toxicological chemistry.</p> <p>Organizational structure of forensic medical examination. Decrees and orders related to the organization of forensic chemical examination and chemical-toxicological analysis of medicinal,</p>

			<p>narcotic drugs and psychotropic substances in case of acute poisoning and the diagnosis of drug and substance abuse intoxication. Analysis of material evidence (forensic chemical examination). The main directions of chemical-toxicological analysis. Chemical-toxicological analysis in acute intoxications and diagnosis of narcotic and toxicomaniac intoxication. Directed and undirected analysis. Documents regulating work in the field of forensic chemical examination and chemical toxicological analysis.</p> <p>Dose (concentration) of a poisonous substance. The concepts of poison, toxic substance, poisoning. Basic parameters of toxicometry. Types, classification, clinical stages of poisoning.</p> <p>General characteristics of the toxic effect. Formation of toxic effect. Physico-chemical characteristics of toxic substances.</p> <p>Strengthening the natural detoxification of the body. Methods of artificial detoxification of the body: intracorporeal, extracorporeal methods. antidote therapy. Physico-chemical (toxicotropic), biochemical, pharmacological antidotes.</p>
2.	UC-1,2 GPC-1,3,6 PC-4,7,12	Biochemical toxicology	<p>Biochemical toxicology. Toxicokinetics of foreign compounds. General patterns of distribution of substances in the body. Factors affecting distribution. Basic toxicokinetic parameters of distribution. Binding to blood serum proteins, to components of organs and tissues. Transport of foreign compounds. Absorption of toxic substances. The structure of membranes. The main mechanisms of transport of substances through membranes: passive diffusion, facilitated diffusion, active transport, filtration, pinocytosis. Diffusion rate and Fick's first law. Distribution of poisons in the body. Features of the toxic effect of toxic substances. Poisonous substances acting locally. The action of toxic substances on receptors. Theory of toxicity receptors. Types of substance-receptor bonds.</p> <p>The concepts of metabolism (biotransformation), "lethal synthesis". The main ways of biotransformation of foreign compounds. Stages of biotransformation. The transformation of substances in the body (1st phase of metabolism). Conjugation of xenobiotics and metabolites (phase II of metabolism). Factors affecting the metabolism of xenobiotics: physiological, genetic and species differences. Influence of environmental factors on the action and metabolism of poisons. The occurrence of chemical, mental, physical</p>

			dependence on certain compounds, allergic reactions, cumulation of foreign compounds and their metabolites. Excretion of xenobiotics and their metabolites from the body: by the kidneys (passive filtration, active transport), bile, with feces, through the lungs, through the skin, with milk, with saliva. Possible transformations of xenobiotics in corpses, formation of cadaveric poisons (ptomains). secondary metabolism.
3.	UC-1,2 GPC-1,3,6 PC-4,7,12	Analytical toxicology	<p>Classification of isolation methods, methods of analysis and groups of toxic substances.</p> <p>General characteristics of substances that cause poisoning (pharmaceuticals, plant protection chemicals, household chemicals, poisons of plant and animal origin). Classification of toxic substances. Characteristics of the objects of forensic chemical and chemical toxicological analysis. Internal organs, blood, urine, saliva, bile, hair, nails, etc., their main composition, the content of toxic substances and their metabolites in bound and free form. Plan for conducting forensic chemical and chemical toxicological analysis. Inspection of the object sent for analysis. Preliminary tests with the object. The choice of isolation method depending on the condition of the object and the circumstances of the case and poisoning. Preparation of objects for isolation of toxic substances. Features of sample preparation of blood and urine for isolation. Degradation of conjugates in urine.</p> <p><i>A group of substances isolated by the method of mineralization ("metal poisons")</i></p> <p>Ecology of the environment and the prevalence of poisoning with compounds of lead, barium, manganese, chromium, silver, copper, bismuth, zinc, antimony, thallium, cadmium, mercury and arsenic.</p> <p>The toxicological significance of "metal poisons", the dependence of the toxicity of metals on their physicochemical properties. Toxicokinetics. Features of the action of compounds of each cation on the body. Mechanisms of metal toxicity. Clinic of poisoning.</p> <p>Research objects.</p> <p><i>Methods for isolating "metal poisons" from biological objects.</i> General and private methods of isolation. Scheme of isolation methods. Isolation of mercury from biological objects. Advantages and disadvantages of methods. Choice of isolation method.</p>

			<p>Fractional (chemical) method for the analysis of "metal poisons". The essence of the method. Peculiarities. General scheme for the analysis of mineralizate for metal and arsenic ions by a fractional method. Complex use of various types of chemical reactions. Analysis of the destructate for mercury ions.</p> <p>Methods for the quantitative determination of "metal poisons". The use of atomic absorption spectroscopy and other spectral methods in the analysis of "metal poisons". Interpretation of the results of the analysis, taking into account the natural content of metals in the body.</p>
4.	UC-1,2 GPC-1,3,6 PC-4,7,12	Analytical toxicology	<p><i>A group of substances isolated by water (mineral acids, alkalis, salts). A group of substances requiring special isolation methods.</i></p> <p><i>A group of substances that do not require special isolation methods (harmful vapors and gases)</i></p> <p>Mineral acids - nitric, sulfuric, hydrochloric; alkalis - hydroxides of sodium, potassium, calcium; ammonia solution, nitrates, sodium and potassium nitrites.</p> <p>General characteristics. toxicological significance. Causes of poisoning. Clinic of poisoning. Research objects. Preliminary samples for the presence of group compounds. Preparation of objects for research. isolation. Purification of extracts by dialysis. Laws on which dialysis is based. Prospects for the use of membrane filtration (nitrocellulose filters, types of membranes).</p> <p>Analysis of dialysate for mineral acids - a preliminary and basic study. Examination of dialysate for sodium, calcium, potassium hydroxides and ammonia solution is a preliminary and main examination. Methods for the quantitative determination of the studied mineral acids, alkalis and salts in the dialysate.</p> <p><i>Extraction with water combined with dialysis.</i> Preparation of objects for research. Prospects for the use of membrane filtration (nitrocellulose filters, types of membranes).</p> <p>Isolation from objects. Analysis of dialysate for mineral acids - preliminary and basic. Detection using chemical reactions of sulfuric acid, nitric acid, hydrochloric acid. Examination of dialysate for nitrites and nitrates. Preliminary analysis and main study. Detection by chemical reactions of nitrites, nitrates. Examination of dialysate for caustic alkalis and ammonia. Use of qualitative reactions for the detection of sodium and potassium</p>

			<p>hydroxides. Analysis of dialysate for the presence of ammonia.</p> <p>Methods for the quantitative determination of mineral acids, nitrites, nitrates, caustic alkalis and ammonia in dialysates.</p> <p>A group of substances requiring special isolation methods: fluorine compounds (sodium fluoride and silicofluoride), tetraethyl lead, ethyl mercuric chloride, chlorine, bromine, iodine. Features of the isolation of these compounds, toxicological effects, detection methods, quantitative determination.</p> <p>A group of toxicologically important substances that do not require special isolation methods. Harmful vapors and gases. Carbon monoxide (II). Physicochemical characteristics. Sources and causes of poisoning, clinic of poisoning, toxicokinetics. Objects of study (blood, air), sampling rules. Detection of carbon monoxide (II) using the colorimetric method and chemical reactions. Microdiffusion method. Gas adsorption and spectrophotometric methods in the analysis of carbon monoxide (II). Carbon monoxide (IV), nitrogen oxides, sulfur, hydridesp-elements of groups V and VI.</p> <p>The concept of hematotoxicity, functions and properties of hemoglobin, methemoglobin formation, formation of carboxyhemoglobin, symptoms of manifestation, laboratory diagnostics.</p>
5.		Analytical toxicology	<p><i>A group of substances isolated by extraction and sorption (medicinal and narcotic substances, pesticides)</i></p> <p><i>Forensic chemical analysis of medicinal and narcotic substances</i></p> <p>Isolation of medicinal and narcotic substances from biological objects. The choice of objects of research (material evidence). Characteristics of the objects of study (internal organs, bile, blood, urine, skin, muscle tissue, gastric lavage, vomit, etc.). Rules for sending objects for analysis. Preparation of objects for research. The choice of a method for isolating medicinal and narcotic substances from biological objects (internal organs, food raw materials and plant products). Theoretical foundations of isolation. General and private methods of isolation. Stages of isolation of medicinal and narcotic substances from biological objects. Factors determining the efficiency of the extraction of the desired substances from objects at the stage of their infusion in a polar solvent (I</p>

		<p>stage). Infusion of objects in acidified alcohol, acetone, acidified water and alkalinized water. Advantages and disadvantages of the solvents used. Factors determining the efficiency of extraction of the desired substances from extracts using a non-polar solvent (II stage). Methods for purification of extracts and extracts. Fundamentals of liquid-liquid extraction. Solid-liquid extraction (sorption) on modified polymers and silica gels.</p> <p><i>A group of medicinal, narcotic drugs and psychotropic substances of the greatest toxicological significance.</i></p> <p>Group of medicinal and narcotic drugs used in medical practice:</p> <p>Alkaloids and synthetic compounds:</p> <ul style="list-style-type: none"> <li>- opium alkaloids, benzylisoquinoline derivatives: papaverine, morphinan derivatives: morphine, codeine; semi-synthetic analogues: ethylmorphine; analogues for the action of morphine: tramadol, trimeperidine, fentanyl, a mixture of opium alkaloid hydrochlorides: omnopon (morphine, codeine, thebaine, papaverine, narcotine);</li> <li>- derivatives of p-aminobenzoic acid: procaine, procainamide;</li> <li>- derivatives of barbituric acid: amobarbital, barbital, butobarbital, pentobarbital, phenobarbital;</li> <li>- derivatives of 1,4-benzodiazepine: diazepam, nitrazepam, oxazepam, chlordiazepoxide;</li> <li>- indole derivatives: strychnine;</li> <li>- pyrazolone derivatives: metamizole sodium, propyphenazone;</li> <li>- pyridine and piperidine derivatives: anabasine, nicotine, pachycarpine;</li> <li>- purine derivatives: caffeine;</li> <li>- tropane derivatives: atropine, cocaine;</li> <li>- derivatives of phenylalkylamine: amphetamine, ephedrine;</li> <li>- phenothiazine derivatives: levomepromazine, promethazine, sonapax, chlorpromazine;</li> <li>- quinoline derivatives: quinine.</li> </ul> <p>A group of narcotic and psychotropic substances, the circulation of which is prohibited in the Russian Federation (list 1):</p> <p>Hallucinogens:</p> <ul style="list-style-type: none"> <li>- indole derivatives: LSD, psilocin, psilocybin, bufotein;</li> <li>- phencyclidine and its analogues: tenocyclidine, rolycyclidine, ethycyclidine;</li> <li>- cannabis (marijuana), hashish (anasha), hash oil (cannabis oil);</li> <li>- poppy straw, opium;</li> <li>- semi-synthetic derivatives of morphinan:</li> </ul>
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		<p>diacetylmorphine (heroin), oripavin;</p> <ul style="list-style-type: none"> <li>- opioids-analogues of the action of morphine: methadone;</li> <li>- phenylalkylamine derivatives: methamphetamine, methylenedioxyamphetamine (MDMA), ephedron.</li> </ul> <p>General characteristics of medicinal and narcotic substances, their physical and chemical properties: solubility in water, organic solvents, ionization constants of acids and bases. toxicological significance. Toxicokinetics. Clinic of poisoning. Metabolism of drugs and drugs. The main methodological approaches in the conduct of forensic chemical examination and chemical toxicological analysis in acute poisoning and the diagnosis of drug and substance abuse.</p> <p><i>Chemical-toxicological analysis of medicinal and narcotic substances in acute poisoning for the purpose of diagnosis and treatment.</i> The prevalence of acute poisoning. Acute poisoning as an actual problem of modern medicine. Nature, causes, classification of poisonings. Organization of specialized care for patients with acute poisoning and analytical diagnostic services. Chemical-toxicological laboratories of the Centers for the treatment of acute poisoning, hospitals. Goals and objectives.</p> <p>Objects of study and their characteristics (blood, urine, gastric lavage, vomit, substances, drugs, etc.).</p> <p><i>Chemical-toxicological analysis of narcotic drugs, psychotropic and other toxic substances for the purpose of diagnosing intoxication (intoxication)</i></p> <p>Chemical-toxicological characteristics of substances. Terminology (drug addiction, substance abuse, narcotic drug, alcohol abuse, psychotropic substances, etc.). Lists of narcotic drugs and psychotropic substances, precursors, poisonous and potent substances. Responsibility for offenses related to drug addiction. Organization of narcological assistance to the population. Chemical-toxicological laboratory of a narcological dispensary or narcological hospital. Goals and objectives. Objects of study and their characteristics: blood, urine, saliva, hair, nails, sweat-fat skin secretions (washings from the skin of the hands), substances, handicraft preparations, objects of plant nature and extracts from them. Methods used in the chemical-toxicological analysis of narcotic substances. Fundamentals of chemical-toxicological analysis in the diagnosis of</p>
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		<p>drug intoxication. Epidemiology of alcoholism, drug addiction, substance abuse. Diagnosis and treatment of acute poisoning by narcotic and psychotropic substances. Methods of treatment and prevention of drug addiction, substance abuse.</p> <p><i>The main methodological approaches in the conduct of forensic chemical examination and chemical toxicological analysis</i></p> <p>Features of conducting forensic chemical and chemical toxicological analysis in conditions of emergency care for patients with acute poisoning and diagnosis of drug and substance abuse intoxication. Directed and undirected analysis. Modern chemical and physico-chemical methods used for preliminary and main research on medicinal, narcotic and psychotropic substances.</p> <p><i>Methods of preliminary research</i></p> <p>Analytical screening in forensic chemical examination and chemical toxicological analysis using thin layer chromatography (TLC screening). Chromatography plates and solvent systems (general).</p> <p>The use of chemical reactions: group-wide staining reactions and reactions with precipitation reagents in the screening of medicinal and narcotic substances. Pharmacognostic study of plant raw materials. TLC screening in the "Toxi-Lab" variant, GLC screening in the analysis of medicinal and narcotic substances in urine extraction. Immunochemical methods for screening medicinal and narcotic substances: homogeneous and heterogeneous immunoassay, enzyme immunoassay (ELISA), polarization fluoroimmunoassay (PFIA), radioimmunoassay (RIA). The use of express and immune tests in the analysis of narcotic substances. Interpretation of the results of the preliminary study.</p> <p><i>Methods of the main study (confirmatory analysis)</i></p> <p>Principles of the combined use of various methods in the identification of medicinal and narcotic substances. Use of staining, fluorescence and microcrystalloscopic reactions. TLC method in a private solvent system with "witnesses", methods of gas-liquid chromatography (GLC), high performance liquid chromatography (HPLC).</p> <p>Spectral methods. Spectrophotometry in the UV, visible and IR regions of the spectrum. Luminescent (fluorescent) analysis. Mass spectrometry, chromato-mass spectrometry.</p>
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		<p>Biological methods, pharmacological tests. Pharmacognostic analysis of plant raw materials in order to identify some alkaloids.</p> <p>Influence of various factors (presence of endogenous compounds, metabolites) on the results of detection of medicinal and narcotic substances in biological objects.</p> <p>Possibilities of use and limitations, their rational combination in forensic chemical examination and chemical toxicological analysis. Advantages and disadvantages of methods. Limits of detection and specificity.</p> <p><i>Quantification methods</i></p> <p>Optical methods. Photocolorimetry. Extraction photometry. Spectrophotometry in the UV and visible regions (direct and differential), chromatography. Mass spectrometry. GLC and HPLC methods. Immunochemical methods. Scheme of analysis. Processing the results of quantitative analysis. Informativeness of quantitative analysis data during forensic chemical examination and chemical toxicological analysis.</p> <p>Poisons of plant origin. Poisonous plants and mushrooms. Toxic substances contained in poisonous plants and fungi. Features of the method for isolating these compounds, toxicological effects, methods of detection. Providing first aid in case of poisoning.</p> <p>Pesticides: organochlorine derivatives (DDT, hexachloran, heptachlor, etc.), organophosphorus derivatives (FOS) (thiophos, trichlormetafos-3, karbofos, chlorophos, etc.), carbamic acid esters (sevin), 1st generation pyrethroids (alletrin, resmethrin, etc.), 2nd generation pyrethroids (permethrin, deltamethrin, etc.), 3rd generation pyrethroids (cyfluthrin, bifetrin, etc.). Organic mercury compounds (ethyl mercuric chloride). Pesticides of inorganic nature: zinc phosphide, compounds of copper, arsenic, barium, thallium. General characteristics, principles of classification, the problem of pesticide residues. Sanitary and hygienic examination of the environment and foodstuffs, causes of pesticide poisoning. Toxicological significance, clinic of poisoning, toxicokinetics, metabolism. Methods for detoxifying the body. Objects of analysis. Preparation of objects for analysis. Isolation of pesticides of inorganic and organic nature. Feature of isolation by extraction with organic solvents.</p> <p><i>General methodological approach to the analysis</i></p>
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			<p><i>of extracts from objects for pesticides</i></p> <p>Methods of preliminary research. Methods TLC, GLC, biological method (cholinesterase test for organophosphorus compounds, etc.).</p> <p>Methods of the main research. Chemical method of analysis: chromogenic, sedimentary and microcrystalloscopic reactions, modern physical and chemical methods.</p> <p>Methods of quantitative determination. Chemical and physico-chemical methods (photometry, GLC).</p>
6.	UC-1,2 GPC-1,3,6 PC-4,7,12	Analytical toxicology	<p><i>A group of substances isolated by distillation ("volatile poisons")</i></p> <p>A group of substances isolated by distillation. "Flying poisons". General characteristics of the group. toxicological significance. Features isolation methods. Physical and chemical bases of the steam distillation method. Scope of distillation methods.</p> <p><i>Methods for isolating "volatile poisons"</i> from various objects: simple distillation, steam distillation, microdistillation, microdiffusion. Features of isolation of individual "volatile" poisons.</p> <p><i>Group of "flying poisons"</i>: hydrocyanic acid and its compounds, formaldehyde, ethyl alcohol, methyl alcohol, amyl alcohols, alkyl halides (chloroform, chloral hydrate, carbon tetrachloride, dichloroethane, hexachloroethane), acetone, aromatic hydrocarbons (benzene, toluene), nitrobenzene, aniline, phenol and cresols, ethylene glycol, acetic acid.</p> <p>Properties, toxicological significance and clinic of poisoning. Toxicokinetics, metabolism. Research objects.</p> <p><i>Methods for detecting "flying poisons"</i>: GLC method and GLC screening of "volatile poisons", chemical method, performance features, IR spectroscopy.</p> <p>Examination of alcohol intoxication. Ethyl alcohol and its surrogates: properties, mechanism of action on the human body. Toxicity. Abuse of ethyl alcohol, the problem of alcoholism in society. Research objects. Problems and prevalence of alcoholism. Clinic of ethyl alcohol poisoning. Clinical diagnosis of intoxication Toxicokinetics. Assessment of the degree of intoxication. Research objects. Sampling Rules in living individuals and cadaveric material. Methods of analysis used in analytical diagnostics and forensic chemical examination, preliminary</p>

		<p>qualitative tests for ethyl alcohol in the study of exhaled air and biological fluids. Gas chromatographic analysis of ethyl alcohol in biological objects, food and technical liquids, in alcohol surrogates.</p> <p><i>Methods for the quantitative determination of "volatile poisons":</i> GLC methods, photocolormetry, argentometry, iodimetry, bromatometry. Use for individual substances, features of the analysis of objects in a state of putrefactive decomposition.</p>
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## 5. Volume of the academic discipline and types of academic work

Type of educational work	Labor intensity		Labor intensity (AH) in semesters	
	volume in credit units (CU)	volume in credit units (CU)	7	8
<b>classroom work, including</b>	<b>3</b>	<b>108</b>	<b>66</b>	<b>42</b>
Lectures (L)	0.7	24	14	10
Practicals (P)	2.3	84	52	32
<b>Student's individual work (SIW)</b>	<b>2</b>	<b>72</b>	<b>42</b>	<b>30</b>
Mid-term assessment				
exam	1	36		36
<b>TOTAL LABOR CAPACITY</b>	<b>6</b>	<b>216</b>	<b>108</b>	<b>108</b>

## 6. Content of the academic discipline

### 6.1 Sections of the discipline and types of academic work

p / no.	Name of the section of the academic discipline	Types of educational work (in ACH)						
		L		P			SIW	Total
1.	Toxicological chemistry as a special discipline. Legal basis of chemical-toxicological analysis. Detoxification methods for acute poisoning	6		20			16	42
2.	Biochemical toxicology.	6		20			16	42
3.	Analytical toxicology.	12		44			40	96
	<b>TOTAL</b>	<b>24</b>		<b>84</b>			<b>72</b>	<b>180</b>

\* - 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

p /	Name of lecture topics	Volume in AH
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no.		Semester 7	Semester 8
1.	Toxicological chemistry as a science, its definition and content, goals, objectives.	1	
2.	The concept of a poisonous substance. Types of poisoning. Classification of poisonings. Methods for detoxifying the body.	1	
3	Biochemical toxicology. The action of toxic substances on receptors.	2	
4.	Toxicokinetics and toxicodynamics of foreign compounds.	2	
5.	Metabolism and biotransformation of xenobiotics and poisons in the body.	2	
6.	Toxicokinetics and analysis of "metal poisons".	2	
7.	Toxicological analysis in case of poisoning with mineral acids, alkalis and salts. Characteristics of "flying poisons".	2	
8.	General characteristics of modern methods for isolating medicinal and narcotic substances and their metabolites from various objects. Forensic chemical examination. Characteristics of the objects of analysis for medicinal substances (internal organs, blood, urine, hair, nails, etc.). General characteristics of medicinal and narcotic drugs, psychotropic and other toxic substances.	2	
9.	Natural, synthetic and semi-synthetic opiates. Methods for isolation, detection and quantification. Chemical-toxicological analysis in case of poisoning with tropane derivatives.		3
10.	Medicines are derivatives of purine, indole, pyridine and piperidine, quinoline. Toxicological significance, clinic of poisoning, toxicokinetics, metabolic pathways. Methods for isolation, detection and quantification.		1
elev en.	Medicinal preparations derivatives of 1,4 - benzodiazepine and phenothiazine. Toxicological significance, clinic of poisoning, toxicokinetics, metabolic pathways. Methods of isolation, detection and quantification.		1
12.	Chemical-toxicological analysis in case of poisoning with derivatives of para-aminobenzoic acid and pyrazolone.		1
13.	General characteristics and chemical-toxicological analysis of pesticides. The history of the creation and use of pesticides. Classification. Environmental protection, the problem of pesticide residues. Toxicological significance, toxicokinetics. detox methods. Methodological approach to analysis.		2
14.	Chemical-toxicological analysis in case of poisoning with carbon monoxide (II), fluorides and silicofluorides.		1
15.	Alcohol intoxication and the social significance of alcohol intoxication. Assessment of the degree of intoxication. Preliminary and basic analysis of objects for alcohol.		1
	TOTAL (total - 36 AH)	14	10

## 6.2. Thematic plan of practicals:

p / no.	Name of topics of practical classes	Volume in AH	
		Semester 7	Semester 8
1.	Introduction. Safety engineering. Chemical-toxicological analysis. Organization of forensic chemical examination. Basic documents.	4	
2.	Introduction to toxicological chemistry. Organization of analytical toxicology services. Principles of HTA. Preliminary tests of HTA objects.	4	
3.	Poisons and poisonings. Colorimetric method for the determination of methemoglobin in the blood.	4	
4.	Basic principles of detoxification therapy. The chemical nature of antidotes.	4	
5.	Colloquium "Introduction to toxicological chemistry. Organization of SHE and HTA»	4	
6.	Quantitative structure-activity correlation (QSAR) for drug toxicity prediction.	4	
7.	Fundamentals of toxicodynamics. Potentiometric determination of pH values of model biological media.	4	
8.	Fundamentals of toxicokinetics. Study of the rate of renal diffusion of a xenobiotic through a semi-impermeable membrane.	4	
9.	Colloquium "Fundamentals of Biochemical Toxicology"	4	
10.	Seminar: Biotransformation of toxicants»	4	
elev en.	Chemical-toxicological analysis for a group of substances isolated by extraction with water in combination with dialysis (alkalis, inorganic acids and their salts). isolation. Qualitative analysis and quantitative determination. Determination of nitrates and nitrites in a biological object by spectrophotometry.	4	
12.	Chemical-toxicological analysis for a group of substances isolated by mineralization (metal poisons). isolation basics. Qualitative analysis and quantitative determination. Determination of metallic poisons by the fractional method.	4	
13.	Colloquium "Toxicologically significant substances of inorganic nature: metallic and caustic poisons"	4	
14.	Chemical-toxicological analysis for a group of substances isolated by distillation. "Flying poisons". Physical and chemical bases of the method of isolation of "flying poisons". Basic laws of the isolation method. Isolation from biological material. Hydrocyanic acid. Alkyl halides.		4
15.	Chemical-toxicological analysis for a group of substances isolated by distillation. "Flying poisons". Physical and chemical bases of the method of isolation of "flying poisons". Basic laws of the isolation method. Isolation from biological material. Oxygen-containing compounds: Formaldehyde, Acetone, Acetic acid, Phenol and its derivatives.		4
16.	Examination and clinical diagnosis of alcohol intoxication.		4

	Methods of analysis used in analytical diagnostics and forensic chemical examination. Quantitative analysis of ethyl alcohol. Solution of situational problems.		
17.	Colloquium on the topic "Chemical-toxicological analysis for a group of substances isolated by distillation".		4
18.	Chemical-toxicological analysis for a group of substances isolated by extraction and sorption. Substances of an acidic and neutral nature (Barbiturates). isolation. Qualitative and quantitative analysis.		4
19.	Chemical-toxicological analysis for a group of substances isolated by extraction and sorption. Substances of a basic nature (alkaloids). isolation. Qualitative and quantitative analysis.		4
20.	Colloquium on the topic "Chemical-toxicological analysis for a group of substances isolated by extraction and sorption". Solution of situational problems.		4
21.	Chemical-toxicological analysis for a group of substances that do not require a special method of isolation. Carbon monoxide. Qualitative analysis, quantitative determination.		4
	TOTAL (total - 84 Ah)	52	32

#### 6.7. Types and topics of student's individual work (SIW):

p / no.	Types and topics of SIW	Volume in AH	
		Semester 7	Semester 8
1.	Working with literary and other sources of information on the section under study	6	6
2.	Doing homework provided by the discipline program	3	4
3.	Writing an abstract (essay, report, scientific article) on a given problem	12	12
4.	The study of material submitted for independent work	12	4
5.	Preparation for practical work	6	3
6.	Preparation for examinations and tests	3	3
7.	TOTAL (total - 60 Ah)	42	32

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

No. p / p	semester No.	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.	7	Input control	Toxicological chemistry as a special discipline. Legal basis of chemical-toxicological analysis.	UC-1,2 GPC-1,3,6 PC-4,7,12	Test	10	Computer testing (option is formed by random sampling)

2. 2	7	Input control	Classification of poisons.	UC-1,2 GPC-1,3,6 PC-4,7,12	Test	10	Computer testing (option is formed by random sampling)
3.	7	Input control	Classification of poisoning and methods of detoxification.	UC-1,2 GPC-1,3,6 PC-4,7,12	Test	12	Computer testing (option is formed by random sampling)
4.	7	Frontier control	Toxicological chemistry as a special discipline. Legal bases of HTA. Poisons, poisoning, detoxification methods for acute poisoning.	UC-1,2 GPC-1,3,6 PC-4,7,12	-Test, Test	5	Computer testing (option is formed by random sampling)
5.		Input control	Toxicokinetics of toxicants	UC-1,2 GPC-1,3,6 PC-4,7,12	Test	10	Computer testing (option is formed by random sampling)
6.		Input control	Toxicodynamics of toxicants	UC-1,2 GPC-1,3,6 PC-4,7,12	Test	15	Computer testing (option is formed by random sampling)
7.	7	current control	Biochemical toxicology. Toxicokinetics, toxicodynamics of toxicants.	UC-1,2 GPC-1,3,6 PC-4,7,12	Test, control work	5	Computer testing (option is formed by random sampling)
8.	7	Input control	Biotransformation of toxicants.	UC-1,2 GPC-1,3,6 PC-4,7,12	Test, independent work	2	Computer testing (option is formed by random sampling)

9.	7	current control	A group of substances isolated by the method of mineralization ("metal poisons")	UC-1,2 GPC-1,3,6 PC-4,7,12	Test, control work (situational tasks)	2	Computer testing (option is formed by random sampling)
10.	7	current control	A group of substances isolated by water (mineral acids, alkalis, salts).	UC-1,2 GPC-1,3,6 PC-4,7,12	Test	15	Computer testing (option is formed by random sampling)
11.	8	entrance control,	A group of substances isolated by the distillation method. Fundamentals of the method. Hydrocyanic acid. Alkyl halides.	UC-1,2 GPC-1,3,6 PC-4,7,12	Test, control work (situational tasks)	2	Computer testing (option is formed by random sampling)
12.	8	entrance control,	A group of substances isolated by distillation. Fundamentals of the method. Oxygen-containing toxicants	UC-1,2 GPC-1,3,6 PC-4,7,12	Test, control work (situational tasks)	2	Computer testing (option is formed by random sampling)
13.	8	current control	A group of substances isolated by distillation.	UC-1,2 GPC-1,3,6 PC-4,7,12	Test, control work (situational tasks)	3	Computer testing (option is formed by random sampling)
14.	8	current control.	A group of substances isolated by extraction and sorption (medicinal and narcotic substances, pesticides)	UC-1,2 GPC-1,3,6 PC-4,7,12	Test, control work (situational tasks)	3	Computer testing (option is formed by random sampling)
15.	8	Input control	A group of substances that do not require special isolation	UC-1,2 GPC-1,3,6 PC-4,7,12	Test	15	Computer testing (option is formed)

			methods				by random sampling)
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## 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.	Pleteneva T.V. Toxicological chemistry: textbook / T. V. Pleteneva, A. V. Syroeshkin, T. V. Maksimova. - M. : GEOTAR-Media, 2013. - 512 p. : ill.	-	2
2.	Pleteneva T.V. Toxicological chemistry: textbook[Electronic resource] / T. V. Pleteneva, A. V. Syroeshkin, T. V. Maksimova. - M. : GEOTAR-Media, 2013. - 512 p. – Access mode: EBS"Student Advisor"		
3.	Vergeichik T.Kh. Toxicological Chemistry: a textbook for Pharm students. universities and faculties / T.Kh. Vergeichik; ed. E.N. Vergeichik. - 3rd ed., revised. and additional - M. : MEDpress-inform, 2012. - 432 p.	-	1
4.	Toxicological chemistry. Analytical toxicology: textbook + CD. Eremin S.A., Kaletin G.I., Kaletina N.I. □Electronic resource□ / Ed. RU. Khabrieva, N.I. Kaletina. 2010. - 752 p. - EBS "Student Consultant"	-	
5.	Pyatigorskaya, N.V. Rules for the organization of production and quality control of medicinal products from plant materials: study guide / N.V. Pyatigorskaya. - St. Petersburg: SpecLit, 2013. - 367 p. □ Access mode: <a href="https://speclit.su/image/catalog/978-5-299-00477-9/978-5-299-00477-9.pdf">https://speclit.su/image/catalog/978-5-299-00477-9/978-5-299-00477-9.pdf</a>	Electronic variant	-
6.	Quality control of medicines [Electronic resource]: textbook / ed. T.V. Pleteneva. - M. : GEOTAR-Media, 2014. - Access mode: <a href="http://www.studmedlib.ru/book/ISBN9785970426340.htm">http://www.studmedlib.ru/book/ISBN9785970426340.htm</a>	EBS "Student Advisor"	EBS "Student Advisor"

### 8.2. Further reading

No.	Name according to bibliographic requirements	Number of copies	
		At the department	In library
1.	Modern poisons: Doses, action, consequences. [Electronic resource] / Kolok A.; Per. from English.– M. : Alpina Publisher, 2017. – 215 p.	-	"Student Advisor"
2.	Controlling the safety and quality of food and	-	"Student Advisor"

	children's products: a practical guide[Electronic resource] / Yu.S. Drugov, A.A. Rodin. - 2nd ed. (el.).- M. : BINOM. Knowledge Laboratory, 2015. - 443 p. (Methods in chemistry).		
3.	TLC screening of toxicologically significant compounds isolated by extraction and sorption: study guide / G.V. Ramenskaya, G.M. Rodionova, N.I. Kuznetsova and A.E. Petukhov; ed. A.P. Arzamastsev. - M. : GEOTAR-Media, 2010. - 240 p. : ill. tv.	-	151
4.	Physical research methods and their practical application in chemical analysis[Electronic resource]. Second edition, revised and enlarged: Textbook. - M. : Prometheus, 2015. - 196 p.	-	"Student Advisor"
5.	Medical toxicology: national guidance + 1 electron. disk (CD-Rom)[Electronic resource]/ Association of Clinical Toxicologists, Association of Medical Societies for Quality; ed. E. A. Luzhnikov. - M. : GEOTAR-Media, 2012. - 928 p. : ill. – (National guidelines) .	-	"Student Advisor"
6.	Toxicological chemistry: a textbook for universities / E. M. Salomatin, A. V. Syroeshkin, R. M. Barkhudarov, N. A. Denisova; ed. T. V. Pleteneva. - M. : GEOTAR-Media, 2005. - 512 p. : ill. tv.	-	215
7.	Medical toxicology: national guidance + 1 electron. CD (CD-Rom) / Association of Clinical Toxicologists, Association of Medical Societies for Quality; ed. E. A. Luzhnikov. - M. : GEOTAR-Media, 2012. - 928 p. : ill. – (National guidelines) .		1
8.	Emergency toxicology: a guide / Afanasiev V.V. - M. : GEOTAR-Media, 2010. - 384 p.: ill.	-	2
9.	Emergency toxicology: a guide[Electronic resource] / Afanasiev V.V. - M. : GEOTAR-Media, 2010. - 384 p.: ill.		"Student Advisor"
10.	Examination of fresh fruits and vegetables. Quality and safety: textbook. -ref. allowance[Electronic resource] / T. V. Plotnikova, V. M. Poznyakovsky, T. V. Larina, L. G. Eliseeva; under total ed. V. M. Poznyakovsky. - 6th ed., Rev. and additional - Novosibirsk: Sib. univ. publishing house, 2009. - 308 p., ill. – (Examination of food products and food raw materials).	-	"Student Advisor"
eleven.	Toxicology in tables and charts: textbook[Electronic resource]/ N. Yu. Kelina, N. V. Bezruchko. - St. Petersburg. : Phoenix, 2006. - 144 p. : tables soft. - (Higher education) .	-	"Student Advisor"
12.	Beverage review. Quality and safety: a textbook for students. universities / V. M. Poznyakovsky, V. A. Pomozova, T. F. Kiseleva, L. V. Permyakova. - 6th ed., Rev. and additional - Novosibirsk: Siberian University Publishing House, 2005. - 407 p. : tv. - (Examination of food products and food raw	-	2

	materials).		
13.	Beverage review. Quality and safety: a textbook for students. universities[Electronic resource]/ V. M. Poznyakovsky, V. A. Pomozova, T. F. Kiseleva, L. V. Permyakova. - 6th ed., Rev. and additional - Novosibirsk: Siberian University Publishing House, 2005. - 407 p. : tv. - (Examination of food products and food raw materials).		"Student Advisor"
14.	Ellenhorn, Matthew J. Medical Toxicology: Diagnosis and Treatment of Human Poisoning. V.1 / M. D. Ellenhorn. - M. : Medicine, 2003. - 1048 p. : tv.	-	1
15.	Ellenhorn, Matthew J. Medical Toxicology: Diagnosis and Treatment of Human Poisoning. T.1[Electronic resource]/ M. D. Ellenhorn. - M. : Medicine, 2003. - 1048 p. : tv.		"Student Advisor"
16.	Drugs. Properties. Action. Pharmacokinetics. Metabolism: a manual for employees of narcological hospitals, drug dispensaries, chemical-toxicological and forensic chemical laboratories / N.V. Veselovskaya. - M. : Triada-X, 2000. - 206 p. : soft	-	1
17.	Mechanisms of toxic action of inorganic compounds: monograph / Yu. A. Ershov, T. V. Pleteneva. - M. : Medicine, 1989. - 272 p. : tv.	-	4
18.	selective toxicity. Physical and chemical bases of therapy. In 2 volumes / A. Albert. - M. : Medicine, 1989. - 400 p. and 428 s. : ill. tv.	-	2
19.	Toxicological chemistry: textbook / M. D. Shvaykova. - Ed. 3rd, rev. - M. : Medicine, 1975. - 376 p.	-	20
20.	General toxicology of metals / E. N. Levina. - Leningrad: Medicine, Leningrad. department, 1972. - 184 p. : tab.	-	1
21.	General Metal Toxicology[Electronic resource]/ E. N. Levina. - Leningrad: Medicine, Leningrad. department, 1972. - 184 p. : tab.		"Student Advisor"

#### 8.4. Electronic educational resources for teaching academic subjects

##### 8.4.1. Internal Electronic Library System of the University (IELSU)

Name of the electronic resource	Brief description (content)	Access conditions	Number of users
Internal electronic library system (VEBS)	Proceedings of the teaching staff of the university: textbooks and teaching aids, monographs, collections of scientific papers, scientific articles, dissertations, abstracts	from any computer on the Internet, using an individual login and password	Not limited

	of dissertations, patents.		
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#### 8.4.2. Electronic educational resources acquired by the University

No.	Name of the electronic resource	Brief description (content)	Access conditions	Number of users
1.	DB "Medicine. Healthcare (HPE)" (EBS "Student Consultant"), individual access to ELS for students with disabilities and disabilities	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 Complete	Foreign full-text database of articles from scientific periodicals and	from university computers; from any computer on the Internet, using an	Not limited

		collections of medical and natural science topics	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

N o.	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 publications.	from any computer on the Internet.
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	Federal and regional legislation, judicial practice, financial advice, legislative	from any computer on the Internet

Plus"	comments, etc.	
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## 9. Material and technical support for mastering an academic discipline

### 9.1. List of premises for classroom activities for the discipline

1. Specialized laboratory equipped with a standard set of equipment for chemical and toxicological analysis;

2. Audience equipped with presentation equipment: projector, screen, laptop.

### 9.2. List of equipment for classroom activities for the discipline

1. A set of electronic presentations;

2. A set of equipment for chemical and toxicological analysis: laboratory tables, exhaust ventilation, laboratory glassware;

3. HPLC chromatograph

4. Gas chromatograph

5. Chromatomass spectrometer

6. Spectrophotometer

7. IR spectrometer

8. Analyzer for polarization fluoroimmunoassay

9. Chromatographic chambers, detection chambers and other equipment for TLC

10. Photomineralizer

11. Ion potentiometer

12. Polarograph

13. Apparatus for determining the melting point

14. Ultrathermostat

15. Ultrasonic bath

16. Centrifuge

17. Drying cabinet

18. Muffle Furnace

19. Water distiller

20. Moisture Analyzer

21. Analytical balance

22. Dry-air thermostat

23. Thermal bath

24. Single channel evaporator

### 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,	220	Office Application	LLC "NEW CLOUD TECHNOLOGIES"	283	without limitation, with the right to receive updates for 1 year.

	with no expiration date, 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*

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**CHANGE REGISTRATION SHEET**

working program for the academic discipline  
***NAME OF THE ACADEMIC DISCIPLINE***

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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