

MINISTRY OF HEALTH PROTECTION OF UKRAINE

ODESSA NATIONAL MEDICAL UNIVERSITY

Department of Pharmaceutical Chemistry and Drug Technology

APPROVED

Vice-rector for scientific and pedagogical work

Eduard BURYACHKIVSKY

September 1st, 2024



**WORKING PROGRAM IN THE DISCIPLINE
«PHARMACEUTICAL CHEMISTRY»**

Level of higher education: second (master's degree)

Field of knowledge: 22 «Health care»

Specialty: 226 «Pharmacy, industrial pharmacy»

Educational and professional program: Pharmacy, industrial pharmacy

The working program is based on the educational and professional program "Pharmacy, Industrial Pharmacy" for the training of specialists of the second (master's) level of higher education in specialty 226 "Pharmacy, Industrial Pharmacy" (protocol no. 10 of June 27, 2024).

Developers:

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The working program was approved at the meeting of the Department of Pharmaceutical Chemistry and Drug Technology

Protocol No. 1 from "29 " August 2024

Head of Department



Volodymyr GELMBOLDT

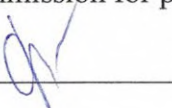
Agreed with the EPP guarantor



Liana UNHURIAN

Approved by the subject cycle methodical commission for pharmaceutical disciplines of ONMedU
Protocol No. 1 from "30 " August 2024

Head of the subject cycle methodical commission for pharmaceutical disciplines of ONMedU



Natalia FIZOR

Reviewed and approved at the department meeting _____

Protocol no ___ from "___" _____ 20__.

Head of the department

_____ Volodymyr GELMBOLDT

Reviewed and approved at the department meeting _____

Protocol no ___ from "___" _____ 20__.

Head of the department

_____ Volodymyr GELMBOLDT

1. Description of the academic discipline:

Name of indicators	Field of knowledge, specialty, specialization, level of higher education	Characteristics of the academic discipline
Total number: Credits: 13 Hours: 390 Content modules: 5	Field of knowledge 22 "Health care"	<i>Full-time education</i>
		<i>Compulsory discipline</i>
	Specialty 226 "Pharmacy, industrial pharmacy"	<i>Year of preparation: 3, 4, 5</i>
		<i>Semesters V - IX</i>
	Level of higher education second (master's)	<i>Lectures (70 h.)</i>
		<i>Practical (190 h.)</i>
		<i>Independent work (130 h.)</i>
		<i>Form of final control – diff. test. Exam</i>
		<i>Correspondence form of education</i>
		<i>Compulsory discipline</i>
		<i>Year of preparation: 3, 4, 5</i>
		<i>Semesters V - IX</i>
		<i>Lectures (26 h.)</i>
		<i>Practical (54 h.)</i>
	<i>Independent work (310 h.)</i>	
	<i>Form of final control – diff. test. Exam</i>	

2. The purpose and tasks of the educational discipline, competencies, learning outcomes of the program.

Goal: to provide systemic knowledge about the structure of medicinal products, methods of their extraction, identification and quantification, physical, physico-chemical and chemical properties, chemical factors of pharmacological action, patterns of relationship structure - biological/pharmacological activity and metabolic transformations, purity research, application and storage, as well as approaches to the creation of new synthetic drugs and biologically active substances.

Task: acquiring skills in the field of providing high-quality pharmaceutical care to patients, taking into account knowledge of the physical, physico-chemical and chemical properties of drugs, the main laws of structure-activity dependence, avoiding possible interaction of drugs in the process of their manufacture and use, establishing the good quality of individual drugs, their multicomponent mixtures and ensuring their proper storage, acquiring knowledge of basic methods of synthesis of medicines or extraction from natural raw materials; in the field of pharmaceutical analysis.

The process of studying the discipline is aimed at forming elements of the following competencies:

General competencies (GC):

GC 1 – Ability to think abstractly, analyze and synthesize, learn and be modernly educated.

GC 2 – Knowledge and understanding of the subject area and understanding of professional activity.

GC 5 – The ability to evaluate and ensure the quality of the work performed.

GC 11 – Ability to apply knowledge in practical situations.

GC 16 – The ability to conduct experimental research at the appropriate level.

Professional competencies (PC):

PC 12 – Ability to ensure proper storage of natural and synthetic drugs and other pharmacy products in accordance with their physico-chemical properties and Good Storage Practice (GSP) rules in healthcare facilities.

PC 19 – Ability to organize and carry out quality control of medicinal products of natural and synthetic origin in accordance with the requirements of the current edition of the State Pharmacopoeia of Ukraine, quality control methods (QC), technological instructions, etc.; to prevent the distribution of low-quality, falsified and unregistered medicinal products.

PC 20 – Ability to develop and evaluate methods of quality control of medicinal products of natural and synthetic origin, including active pharmaceutical ingredients, medicinal plant raw materials and auxiliary substances using physical, chemical, physico-chemical, biological, microbiological, pharmaco-technological methods; carry out standardization of medicinal products in accordance with current requirements.

PC 24 – Ability to use knowledge of regulatory and legal acts of Ukraine and recommendations of proper pharmaceutical practices in professional activity.

Program learning outcomes (PLO):

PLO 3 – Have specialized knowledge and skills/skills for solving professional problems and tasks, including for the purpose of further development of knowledge and procedures in the field of pharmacy.

PLO 20 – Carry out pharmaceutical development of medicinal products of natural and synthetic origin in the conditions of industrial production.

PLO 22 – Ensure and carry out quality control of medicinal products of natural and synthetic origin and document its results; draw up quality certificates and analysis certificates taking into account the requirements of the current edition of the State Pharmacopoeia of Ukraine, quality control methods (QCM), technological instructions, etc.; take measures to prevent the distribution of low-quality, falsified and unregistered medicinal products.

PLO 23 – Determine the main chemical and pharmaceutical characteristics of medicinal products of natural and synthetic origin; choose and/or develop quality control methods for the purpose of their standardization using physical, chemical, physico-chemical, biological, microbiological and pharmaco-technological methods in accordance with current requirements.

PLO 25 – Adhere to the norms of the sanitary and hygienic regime and the requirements of safety equipment when carrying out professional activities.

PLO 28 – Carry out professional communication in the state language, use oral communication skills in a foreign language, analyze specialized texts and translate foreign language information sources.

PLO 29 – To carry out professional activities using information technologies, "Information databases", navigation systems, Internet resources, software and other information and communication technologies.

PLO 36 – Plan and implement professional activities on the basis of normative legal acts of Ukraine and recommendations of proper pharmaceutical practices.

As a result of studying the academic discipline, the student of higher education should:

to know:

- chemical and pharmacological classification of medicines;
- international non-proprietary names of medicinal substances and preparations of which they are a part;
- the main regularities of the "structure-activity" connection, approaches to adequate replacement of medicinal products;
- the main pathways of drug metabolism, the optimal conditions for the action of prodrugs;
- the most common dangers of chemical interaction of drugs with each other and with food products, which can impair bioavailability, safety and effectiveness;
- chemical bases of rational use of medicines;
- state regulation of the quality of medicinal products;
- qualitative analysis of cations and anions, methods of qualitative and quantitative analysis of medicinal products;
- elemental analysis and analysis by functional groups;

- chemical titrimetric methods of analysis;
- gravimetric method of analysis, chromatographic methods of identification, spectral methods of analysis, etc;
- purity research methods;
- methods of prevention and express determination of possible falsification of medicinal products.

be able:

- to determine whether a medicinal product belongs to a pharmacological group, taking into account the chemical structure, to make recommendations regarding the possible replacement of a medicinal product within the pharmacological group;
- provide qualified pharmaceutical care to patients taking into account the physical, physico-chemical and chemical properties of medicinal products;
- to determine the possible interaction of medicines when they are used together and to provide recommendations on how to prevent it;
- to provide information to the patient about the possible unwanted effect of food on the medicinal product;
- determine the optimal conditions for the storage of medicinal products;
- to provide recommendations to the pharmacist during the manufacture of medicinal products regarding possible chemical incompatibility and ways to avoid it;
- use analytical documentation that regulates the quality of medicinal products (State Pharmacopoeia, International Pharmacopoeia, national and regional pharmacopoeias, QCM, relevant orders and instructions);
- use industry standards, methodical guidelines when implementing methods of quality control of substances and medicinal products;
- use chemical, physical, physico-chemical methods in quality control of medicines;
- choose and perform express methods of qualitative and quantitative analysis of dosage forms of internal pharmacy production;
- to give a qualified assessment of the quality of medicinal products according to the results of the analysis.

3. Content of the academic discipline

Content module 1.

PHARMACEUTICAL ANALYSIS

Topic 1 The subject and tasks of pharmaceutical chemistry. The system of evaluation of the quality of medicinal products. Stability of the composition as a necessary condition for all stages of the existence of the medicinal product. Peculiarities of pharmaceutical analysis are related to the intended use of drugs and the professional responsibility of the pharmacist. State principles and provisions regulating the quality of medicinal products. Organization of quality control of medicinal products in Ukraine. State Pharmacopoeia of Ukraine. Modern strategies for creating innovative medicines. Pharmacopoeial analysis.

Topic 2 Identification of medicinal substances of inorganic nature.

Topic 3 Identification of medicinal substances of organic nature by functional groups (functional analysis).

Topic 4 Reasons for changes in the structure of the medicinal substance (influence of light, moisture, temperature and other factors). The nature and character of impurities, methods of their detection.

Topic 5 Methods of quantitative analysis of the content of medicinal products. Gravimetry.

Topic 6 Titrimetric methods of quantitative analysis of medicinal products. Determination of nitrogen in organic compounds.

Topic 7 Analysis of physico-chemical properties of medicinal products as one of the elements of quality assessment of medicinal products.

Topic 8 The use of spectroscopic and chromatographic methods in the identification of medicinal products; peculiarities of using standard samples of medicinal substances and standard spectra.

Topic 9 Chromatographic methods. Methods based on thermodynamic properties of substances. Combination of extraction, chromatographic and optical methods in the analysis of dosage forms.

Topic 10 Optical methods in the quantitative analysis of medicinal products.

Topic 11 Express analysis of medicines. Modern trends in the development of pharmaceutical analysis.

Topic 12 Express analysis of monocomponent medicines.

Topic 13 Express analysis of multicomponent medicines.

Topic 14 Express analysis of medicines. Analysis of an unknown medicinal product.

Content module 2.

Chemical bases of action of medicines. Means affecting the central nervous system

Topic 15 Principles of classification of medicinal products, their nomenclature. Structure-activity relationship in the creation and analysis of medicinal products. Stages of creation of medicines.

Topic 16 The main ways of drug metabolism. Chemical reactions that underlie metabolic transformations. Phases of metabolism. Factors affecting metabolic processes. Prodrugs.

Topic 17 Nonsteroidal anti-inflammatory drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of obtaining, methods of analysis, application in medicine.

Topic 18 Narcotic analgesics and their analogues. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of obtaining, methods of analysis, application in medicine.

Topic 19 Sleep aids. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 20 Means for anesthesia. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 21 Psychotropic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 22 Anticonvulsant and antiepileptic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 23 Means for the treatment of parkinsonism. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 24 Emetics and antiemetics. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 25 Antitussives. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 26 Nootropic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 27 Antihistamines. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Content module 3.

Medicines affecting the nervous, cardiovascular, excretory and blood coagulation systems

Topic 28 Agents affecting the afferent nervous system. Means that stimulate receptors of afferent nerve fibers. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 29 Means that reduce the sensitivity of afferent nerve fibers. Means for local anesthesia. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 30 Means affecting the efferent nervous system. Means acting on cholinergic processes. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 31 Means acting mainly on adrenergic processes. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 32 Cardiogenic means. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 33 Antiarrhythmic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 34 Means that improve blood supply to organs and tissues. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 35 Peripheral vasodilators. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 36 Antagonists of calcium ions. Activators of potassium channels. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 37 Agents affecting the renin-angiotensin system Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 38 Hypotensive and hypertensive drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 39 Angioprotectors. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 40 Antioxidants. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 41 Hypolipidemic agents. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 42 Diuretics. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 43 Agents affecting platelet aggregation and blood coagulation. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Content module 4.

Antimicrobial drugs (chemotherapeutic agents, antiseptics and disinfectants)

Topic 44 Antiseptic and disinfectants. Characteristics, classification, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 45 Antibiotics of heterocyclic structure. β -lactamase inhibitors. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 46 Tetracycline and macrolide antibiotics. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 47 Antibiotics of the aminoglycoside structure, amphenicols, other groups of antibiotics. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 48 Derivatives of 8-oxyquinoline, quinoxaline and nitrofuran. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 49 Sulfanilamides. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 50 Antitubercular drugs. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 51 Derivatives of naphthyridine and quinolonecarboxylic acids. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 52 Medicinal products used for the treatment of oncological diseases (alkylating agents, antimetabolites, alkaloids, antibiotics, hormonal agents and their antagonists, other groups). Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 53 Examples of "targeted" anticancer drugs (drugs of different chemical groups). Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 54 Antiviral means. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 55 Antifungal drugs. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 56 Antimalarial drugs. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 57 Medicines for the treatment of protozoan infections. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 58 Anthelmintics. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 59 Antipediculosis and acaricidal means. Characteristics, classification, methods of preparation, methods of analysis, application in medicine.

Content module 5.

Medicines that affect organ functions, metabolism and immunity

Topic 60 Medicines for thyroid hormones, antithyroid drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 61 Medicines for pancreatic hormones, Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 62 Antidiabetic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 63 Steroid hormones. Corticosteroids. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 64 Androgens, anabolic steroids and their analogues. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 65 Progestogens, estrogens. Birth control. Estrogens of nonsteroidal structure. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 66 Vitamins are water soluble. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 67 Fat-soluble vitamins. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 68 Medicinal products affecting immunity processes (immunotropic agents). Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 69 Anorexigenic means. Sorbents, antidotes and complexons. Anti-ulcer drugs. Means for the treatment of alcoholism. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 70 Radiopaque and other diagnostic tools. Characteristics, classification, mechanism of action, methods of preparation, methods of analysis, application in medicine.

4. The structure of the academic discipline

Names of topics	Number of hours of full-time education					Number of hours of correspondence form of education				
	In total	including				In total	including			
		lectures	seminars	practical	IWS		lectures	seminars	practical	IWS
Content module 1. <i>Pharmaceutical analysis</i>										
Topic 1. Subject and tasks of pharmaceutical chemistry. The system of evaluation of the quality of medicinal products. Peculiarities of pharmaceutical analysis. State principles and provisions regulating the quality of medicinal products. SPhU Modern strategies for creating innovative medicines. Pharmacopoeial analysis	4,5	0,5	0	2	2	2,5	0,5	0	0	2
Topic 2. Identification of medicinal substances of inorganic nature	10,5	0,5	0	8	2	7,5	0,5	0	1	6
Topic 3. Identification of medicinal substances of organic nature by functional groups	7	1	0	6	2	7,5	0	0	1	6

(functional analysis).										
Topic 4. Reasons for changes in the structure of the medicinal substance (influence of light, moisture, temperature and other factors. Nature and nature of impurities, methods of their detection.	2,5	0,5	0	0	2	7	0	0	1	6
Topic 5. Methods of quantitative analysis of the content of medicinal products. Gravimetry.	6,5	0,5	0	4	2	7,5	0,5	0	1	6
Topic 6. Titrimetric methods of quantitative analysis of medicinal products.	20	1	0	18	1	7,5	0,5	0	1	6
Topic 7. Analysis of physico-chemical properties of medicinal products as one of the elements of quality assessment of medicinal products.	4	1	0	1	2	6,5	0,5	0	1	6
Topic 8. The use of spectroscopic and chromatographic methods in the identification of medicinal products; peculiarities of using standard samples of medicinal substances and standard spectra.	3,5	0,5	0	1	2	6	0	0	0	6
Topic 9. Chromatographic methods. Methods based on thermodynamic properties of substances. Combination of extraction, chromatographic and optical methods in the analysis of dosage forms.	5	1	0	2	2	7,5	0,5	0	1	6
Topic 10. Optical methods in the quantitative analysis of medicinal products.	6,5	0,5	0	4	2	7,5	0,5	0	1	6
Topic 11. Express analysis of medicines. Modern trends in the development of pharmaceutical analysis.	2	1	0	0	1	7	0	0	1	6

Topic 12. Express analysis of monocomponent medicines.	4	1	0	1	2	6,5	0	0	0,5	6
Topic 13. Express analysis of multicomponent medicinal products.	5,5	0,5	0	1	4	7,5	0	0	0,5	7
Topic 14. Express analysis of medicines. Analysis of an unknown medicinal product.	6,5	0,5	0	2	4	7	0	0	1	6
<i>Together according to content module 1</i>	88	10	0	50	30	95	4	0	10	81
Content module 2.										
Chemical bases of action of medicines. Means affecting the central nervous system										
Topic 15. Principles of classification of medicinal products, their nomenclature. Structure-activity relationship in the creation and analysis of medicinal products. Stages of creation of medicines	4,5	1	0	2	1,5	3,5	0,5	0	1	2
Topic 16. Main ways of drug metabolism. Chemical reactions that underlie metabolic transformations. Phases of metabolism. Factors affecting metabolic processes. Prodrugs	4,5	2	0	0	2,5	3,5	0,5	0	1	2
Topic 17. Nonsteroidal anti-inflammatory drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of obtaining, methods of analysis, application in medicine.	8	2	0	4	2	8	1	0	1	6
Topic 18. Narcotic analgesics and their analogues. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of obtaining, methods of analysis, application in medicine.	6	2	0	2	2	7,5	0,5	0	1	6

Topic 19. Sleep aids. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	6	2	0	2	2	7,5	0,5	0	1	6
Topic 20. Means for anesthesia. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	7	2	0	4	1	7,5	0,5	0	1	6
Topic 21. Psychotropic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	15	2	0	6	7	7,5	0,5	0	1	6
Topic 22. Anticonvulsant and antiepileptic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	4,5	1,5	0	2	1	8	0,5	0	0,5	7
Topic 23. Means for the treatment of parkinsonism. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis,	8,5	1	0	4	3,5	7	0,5	0	0,5	6

application in medicine.										
Topic 24. Emetics and antiemetics. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	6,5	1	0	4	1,5	6,5	0	0	0,5	6
Topic 25. Antitussives. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	4,5	1,5	0	2	1	8	0,5	0	0,5	7
Topic 26. Nootropic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	6,5	1	0	2	3,5	8	0,5	0	0,5	7
Topic 27. Antihistamines. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	8,5	1	0	6	1,5	7,5	0	0	0,5	7
<i>Total according to content module 2</i>	<i>90</i>	<i>20</i>	<i>0</i>	<i>40</i>	<i>30</i>	<i>90</i>	<i>6</i>	<i>0</i>	<i>10</i>	<i>74</i>
Content module 3.										
Medicines affecting the nervous, cardiovascular, excretory and blood coagulation systems										
Topic 28. Means affecting the afferent nervous system. Means that stimulate receptors of afferent nerve fibers.	6	1	0	4	1	3,5	0,5	0	1	2

Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.										
Topic 29. Means that reduce the sensitivity of afferent nerve fibers. Means for local anesthesia. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	4	1	0	2	1	3	0	0	1	2
Topic 30. Means affecting the efferent nervous system. Means acting on cholinergic processes. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	6	1	0	4	1	3	0	0	1	2
Topic 31. Means acting mainly on adrenergic processes. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	4	1	0	2	1	3,5	0,5	0	1	2
Topic 32. Cardiotonic drugs. Characteristics, classification, relationship	3,5	0,5	0	2	1	3,5	0,5	0	2	1

between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.										
Topic 33. Antiarrhythmic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	3,5	0,5	0	2	1	3	0	0	1	2
Topic 34. Means that improve blood supply to organs and tissues. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2,5	0,5	0	1	1	3,5	0,5	0	1	2
Topic 35. Peripheral vasodilators. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2,5	0,5	0	1	1	3,5	0,5	0	1	2
Topic 36. Antagonists of calcium ions. Activators of potassium channels. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis,	3,5	0,5	0	2	1	3,5	0	0	0,5	3

application in medicine.										
Topic 37. Agents affecting the renin-angiotensin system Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	3,5	0,5	0	2	1	3,5	0	0	0,5	3
Topic 38. Hypotensive and hypertensive drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	3,5	0,5	0	2	1	4	0,5	0	0,5	3
Topic 39. Angioprotectors. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2	0	0	2	1	4	0,5	0	0,5	3
Topic 40. Antioxidants. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2,5	0,5	0	2	1	5,5	0,5	0	0	5
Topic 41. Hypolipidemic agents. Characteristics, classification, relationship between structure and pharmacological action, mechanism	4,5	0	0	2	0,5	4	0	0	0	4

of action, methods of preparation, methods of analysis, application in medicine.										
Topic 42. Diuretics. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	7	2	0	4	1	5	0	0	1	4
Topic 43. Agents affecting platelet aggregation and blood coagulation. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	6,5	0	0	6	0,5	4	0	0	0	4
<i>Total according to content module 3</i>	<i>65</i>	<i>10</i>	<i>0</i>	<i>40</i>	<i>15</i>	<i>60</i>	<i>4</i>	<i>0</i>	<i>12</i>	<i>44</i>
Content module 4.										
Antimicrobial drugs (chemotherapeutic agents, antiseptics and disinfectants)										
Topic 44. Antiseptic and disinfectants. Characteristics, classification, mechanism of action, methods of preparation, methods of analysis, application in medicine.	10	1	0	8	1	6	2	0	2	2
Topic 45. Antibiotics of heterocyclic structure. β -lactamase inhibitors. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	3,5	0,5	0	2	1	3,5	0,5	0	1	2
Topic 46. Tetracycline and macrolide antibiotics. Characteristics,	3,5	0,5	0	2	1	3	0	0	1	2

classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.										
Topic 47. Antibiotics of the aminoglycoside structure, amphenicols, other groups of antibiotics. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	3	1	0	1	1	3	0	0	1	2
Topic 48. Derivatives of 8-oxyquinoline, quinoxaline and nitrofurans. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2,5	0,5	0	1	1	3,5	0,5	0	1	2
Topic 49. Sulfanilamides. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	4	1	0	2	1	3,5	0,5	0	1	2
Topic 50. Anti-tuberculosis drugs. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	3,5	1	0	2	0,5	3	0	0	1	2

Topic 51. Derivatives of naphthyridine and quinolone carboxylic acids. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	3,5	0,5	0	2	1	4	0	0	0	4
Topic 52. Medicines used for the treatment of oncological diseases (alkylating agents, antimetabolites, alkaloids, antibiotics, hormonal agents and their antagonists, other groups). Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	3	0,5	0	0	2,5	5	0	0	1	4
Topic 53. Examples of "targeted" anticancer drugs (drugs of various chemical groups). Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	3	0	0	0	3	4,5	0,5	0	0	4
Topic 54. Antiviral means. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2,5	0,5	0	0	2	3	0	0	1	2
Topic 55. Antifungal drugs. Characteristics,	3	1	0	0	2	3,5	0	0	0,5	3

classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.										
Topic 56. Antimalarial drugs. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2,5	0,5	0	0	2	3,5	0	0	0,5	3
Topic 57. Medicines for the treatment of protozoan infections. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2,5	0,5	0	0	2	3,5	0	0	0,5	3
Topic 58. Anthelmintics. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2,5	0,5	0	0	2	3,5	0	0	0,5	3
Topic 59. Antipediculis and acaricidal means. Characteristics, classification, methods of preparation, methods of analysis, application in medicine.	2,5	0,5	0	0	2	4	0	0	0	4
<i>Total according to content module 4</i>	<i>55</i>	<i>10</i>	<i>0</i>	<i>20</i>	<i>25</i>	<i>60</i>	<i>4</i>	<i>0</i>	<i>12</i>	<i>44</i>
Content module 5.										
Medicines that affect organ functions, metabolism and immunity										
Topic 60. Medicinal products for thyroid hormones, antithyroid drugs.	9	1	0	4	4	8	0,5	0	1	7

Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.										
Topic 61. Drugs of pancreatic hormones, Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	7	1	0	2	4	7	0	0	0	7
Topic 62. Antidiabetic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	9	0	0	4	5	7	0	0	0	7
Topic 63. Steroid hormones. Corticosteroids. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	11	2	0	8	1	9	1	0	1	7
Topic 64. Androgens, anabolic steroids and their analogues. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis,	7	2	0	2	3	8,5	0,5	0	1	7

application in medicine.										
Topic 65. Progestogens, estrogens. Birth control. Estrogens of nonsteroidal structure. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	11	2	0	6	3	8,5	0,5	0	1	7
Topic 66. Water-soluble vitamins. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	15	4	0	10	1	11	2	0	2	7
Topic 67. Fat-soluble vitamins. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	7	4	0	4	0	11	2	0	2	7
Topic 68. Medicinal products affecting immunity processes (immunotropic agents). Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	3	0	0	0	3	7	0	0	0	7
Topic 69. Anorexigenic means. Sorbents, antidotes and complexons. Anti-	6	4	0	0	2	9	0	0	2	7

ulcer drugs. Means for the treatment of alcoholism. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.										
Topic 70. Radiopaque and other diagnostic tools. Characteristics, classification, mechanism of action, methods of preparation, methods of analysis, application in medicine.	4	0	0	0	4	4	0	0	0	4
<i>Tota; according to content module 5</i>	90	20	0	40	30	90	6	0	10	74
<i>Individual tasks</i>	0	0	0	0	0	0	0	0	0	0
Total in hours	390	70	0	190	130	390	26	0	54	310

5. Topics of lectures / seminars / practical / laboratory lessons

5.1. Topics of lectures

№	Topic name	Number of hours
1.	Subject and tasks of pharmaceutical chemistry, history of development. The system of evaluation of the quality of medicines. The State Pharmacopoeia of Ukraine, its structure.	2
2.	Physico-chemical methods of analysis in the identification of medicines.	2
3.	Methods of identification of medicines.	2
4.	Methods of quantitative analysis of medicines. Acid-base titration. Complexonometry. Precipitation titration.	2
5.	Methods of quantitative analysis of medicines. Methods of redox titration. Gravimetry.	2
6.	Express analysis of medicines. Modern trends in the development of pharmaceutical analysis.	2
7.	Principles of classification of medicines, their nomenclature. Structure-activity relationship. The main ways of drug metabolism. Prodrugs	2
8.	Basics of the strategy of creating new synthetic medicines.	2
9.	Nonsteroidal anti-inflammatory drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2

10.	Narcotic analgesics and their analogues. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
11.	Means for anesthesia. Psychotropic drugs. Neuroleptics. Antidepressants. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
12.	Psychotropic drugs. Tranquilizers. Sedative Psychostimulants. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
13.	Psychotropic and hypnotic drugs. Barbituric acid derivatives. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
14.	Anticonvulsant and antiepileptic drugs. Means for the treatment of parkinsonism. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of obtaining, methods of analysis, application in medicine.	2
15.	Emetics and antiemetics. Antitussives. Nootropic drugs. Antihistamines. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
16.	Agents affecting the afferent nervous system. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of obtaining, methods of analysis, application in medicine.	2
17.	Agents that affect the efferent nervous system. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
18.	Cardiotonic, antiarrhythmic medicines. Means that improve blood supply to organs and tissues. Peripheral vasodilators. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
19.	Antagonists of calcium ions. Antioxidants. Agents affecting the renin-angiotensin system. Hypo- and hypertensive medicines. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine	2
20.	Agents affecting the excretory system (diuretics). Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
21.	Antibiotics. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
22.	Antimicrobial medicines. Sulfanilamides. Derivatives of naphthyridine and quinolone-carboxylic acids. Derivatives of 8-oxyquinoline, quinoxaline and nitrofuril. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
23.	Anti-tuberculosis medicines. Means for the treatment of oncological diseases. Antiviral and antimalarial agents. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine	2
24.	Antifungal medicines. Medicines for the treatment of protozoan infections. Anthelmintics. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2

25.	Antiseptic and disinfectants. Antipediculosis and acaricidal means. Characteristics, classification, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
26.	Medicines of thyroid hormones. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of obtaining, methods of analysis, application in medicine.	2
27.	Steroid hormones and their analogues: corticosteroids and their synthetic analogues. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of obtaining, methods of analysis, application in medicine.	2
28.	Steroid hormones and their analogues: progestogens, androgens and their analogues. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of obtaining, methods of analysis, application in medicine.	2
29.	Steroid hormones and their analogues: estrogens and their analogues, synthetic compounds of estrogenic action. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of obtaining, methods of analysis, application in medicine.	2
30.	Aliphatic vitamins. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of obtaining, methods of analysis, application in medicine.	2
31.	Vitamins of the alicyclic, aromatic series. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of obtaining, methods of analysis, application in medicine.	2
32.	Heterocyclic vitamins: derivatives of chroman, rutin, derivatives of pyridine. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of obtaining, methods of analysis, application in medicine.	2
33.	Heterocyclic vitamins: pyrimidine and thiazole derivatives, isoalloxazine derivatives, pterin derivatives, corin derivatives. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of obtaining, methods of analysis, application in medicine.	2
34.	Anorexigenic means. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of obtaining, methods of analysis, application in medicine.	2
35.	Anti-ulcer drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of obtaining, methods of analysis, application in medicine.	2
<i>The number of lecture hours in the discipline</i>		50

5.2. Topics of seminar lessons

Seminar lessons are not provided.

5.3. Topics of practical lessons

№	Topic name	Number of hours
1.	Topic 1. Practical lesson 1. The subject and tasks of pharmaceutical chemistry. The system of evaluation of the quality of medicinal products. Stability of the composition as a necessary condition for all stages of the existence of the medicinal product.	2
2.	Topic 2. Practical lesson 2.	2

	Identification of medicinal substances of an inorganic nature according to the SPhU.	
3.	Topic 2. Practical lesson 3. Laboratory work: Analysis of cations and anions.	2
4.	Topic 2. Practical lesson 4. Analysis of medicinal substances for the limit level of ion impurities.	2
5.	Topic 2. Practical lesson 5. Laboratory work: Analysis of the limit level of ion impurities.	2
6.	Topic 3. Practical lesson 6. Identification of medicinal substances of organic nature by functional groups (functional analysis).	2
7.	Topic 3. Practical lesson 7. Laboratory work: Analysis by functional groups	2
8.	Topic 1-3. Practical lesson 8. Solving situational and test tasks on the Analysis of medicinal substances of an inorganic nature and functional analysis.	2
9.	Topic 5. Practical lesson 9. Methods of analysis of the quantitative content of medicinal products.	2
10.	Topic 5. Practical lesson 10. Gravimetric analysis of medicines.	2
11.	Topic 6. Practical lesson 11. Titrimetric methods of analysis. Classification of methods. Acid-base titration in an aqueous environment.	2
12.	Topic 6. Practical lesson 12. Acid-base titration in a non-aqueous medium.	2
13.	Topic 6. Practical lesson 13. Laboratory work: Quantitative determination of hydrochloric acid.	2
14.	Topic 6. Practical lesson 14. Titrimetric precipitation methods. Methods of complex formation.	2
15.	Topic 6. Practical lesson 15. Laboratory work: Quantitative determination of the substance Sodium chloride by Mohr's method.	2
16.	Topic 6. Practical lesson 16. Laboratory work: Quantitative determination of magnesium sulfate by complexometry.	2
17.	Topic 6. Practical lesson 17. Redox titration.	2
18.	Topic 6. Practical lesson 18. Laboratory work: Quantitative determination of 3% hydrogen peroxide solution by permanganometry.	2
19.	Topic 5-6. Practical lesson 19. Solving situational and test tasks on Methods of quantitative analysis of the content of medicinal products.	2
20.	Topic 7-8. Practical lesson 20. Spectral methods of drug analysis.	2
21.	Topic 9. Practical lesson 21. Chromatographic methods of drug analysis.	2
22.	Topic 10. Practical lesson 22. Optical methods of drug analysis.	2
23.	Topic 10. Practical lesson 23.	2

	Laboratory work: Quantitative determination of Glucose solution p/in. 40% 20 ml by the method of polarimetry.	
24.	Topic 12-14. Practical lesson 24. Express analysis of single-component and complex medicines.	2
25.	Topic 7-14. Practical lesson 25. Solving situational and test tasks on Physico-chemical methods of analysis.	2
26.	Topic 15. Practical lesson 26. Principles of classification of medicinal products, their nomenclature. Structure-activity relationship in the creation and analysis of medicinal products. The main ways of drug metabolism. Factors affecting metabolic processes. Prodrugs	2
27.	Topic 17. Practical lesson 27. Nonsteroidal anti-inflammatory drugs (NSAIDs). Sodium salicylate, acetylsalicylic acid, metamizole sodium salt, butadione, paracetamol, sodium diclofenac.	2
28.	Topic 17. Practical lesson 28. Laboratory work: Analysis of Analgin tab. 500 mg.	2
29.	Topic 18. Practical lesson 29. Narcotic analgesics and their analogues. Morphine hydrochloride, codeine, codeine phosphate, fentanyl, promedol.	2
30.	Topic 19. Practical lesson 30. Sleep aids. Derivatives of barbituric acid, chloral hydrate, bromisoval.	2
31.	Topic 20. Practical lesson 31. Means for anesthesia. Medical ether, flurothane, nitrous oxide, sodium thiopental, hexenal.	2
32.	Topic 15-20. Practical lesson 32. Solving situational and test tasks on the pharmaceutical analysis of non-steroidal anti-inflammatory drugs, narcotic analgesics, hypnotics, anesthetics.	2
33.	Topic 21. Practical lesson 33. Psychotropic drugs. Part 1. Neuroleptics: phenothiazine derivatives, chlorprothixene, haloperidol. Antidepressants: imizin, amitriptyline, nialamide, transamine.	2
34.	Topic 21. Practical lesson 34. Psychotropic drugs. Part 2. Tranquilizers: benzodiazepine derivatives, meprostan, amisil.	2
35.	Topic 21. Practical lesson 35. Psychotropic drugs. Part 3. Sedatives: sodium and potassium bromide. Psychostimulants: phenamine, pyridrol, sodium caffeine benzoate, cocaine hydrochloride.	2
36.	Topic 22. Practical lesson 36. Anticonvulsant and antiepileptic drugs. Phenobarbital, carbamazepine, difenin, clonazepam, hexamidine, sodium valproate.	2
37.	Topic 23. Practical lesson 37. Means for the treatment of parkinsonism. Levodopa, bromocriptine, selegiline, mydantan, cyclodol.	2
38.	Topic 21-23. Practical lesson 38. Solving situational and test tasks on the pharmaceutical analysis of psychotropic drugs, anticonvulsant and antiepileptic drugs, drugs for the treatment of parkinsonism.	2

39.	Topic 24. Practical lesson 39. Emetics and antiemetics. Emetics: copper sulfate pentahydrate, zinc sulfate heptahydrate. Antiemetics: scopolamine, diprazine, stageperazine, tryptazine.	2
40.	Topic 24. Practical lesson 40. Laboratory work: Analysis of the substance Copper sulfate pentahydrate.	2
41.	Topic 25. Practical lesson 41. Means for the treatment of cough. Codeine, Codeine phosphate, ethylmorphine hydrochloride, libexin.	2
42.	Topic 26. Practical lesson 42. Nootropic drugs. Piracetam, GABA, aminalon, picamilon, glycine.	2
43.	Topic 27. Practical lesson 43. Antihistamines. Diphenhydramine (diphenhydramine hydrochloride), suprastin, diazolin, diprazine.	2
44.	Topic 27. Practical lesson 44. Laboratory work: Analysis of Diphenhydramine solution p/in. 1% 1 ml.	2
45.	Topic 24-27. Practical lesson 45. Solving situational and test tasks on the pharmaceutical analysis of emetics and antiemetics, means for the treatment of cough, nootropics, antihistamines.	2
46.	Topic 28. Practical lesson 46. Means that stimulate receptors of afferent nerve fibers. Antacids, enveloping and binding agents: Aluminum hydroxide, Magnesium oxide, Basic magnesium carbonate, Basic bismuth nitrate Adsorbents: Activated carbon	2
47.	Topic 28. Practical lesson 47. Means that stimulate receptors of afferent nerve fibers. Expectorants: Terpene hydrate, Sodium benzoate, Acetylcysteine Irritants: Menthol racemic, Validol Laboratory work: Analysis of the substance Sodium benzoate.	2
48.	Topic 29. Practical lesson 48. Means that reduce the sensitivity of afferent nerve fibers. Means for local anesthesia. Esters of p-aminobenzoic acid: Benzocaine, Procaine hydrochloride Acetanilide derivatives: Lidocaine hydrochloride Arylamides of piperidinecarboxylic acids: Bupivacaine hydrochloride, Articaine hydrochloride	2
49.	Topic 30. Practical lesson 49. Means affecting the efferent nervous system. Means acting on cholinergic processes. Means acting on cholinergic receptors. Cholinomimetics: Pilocarpine hydrochloride Anticholinesterase drugs of reversible action: Neostigmine methylsulfate Irreversible anticholinesterase drugs: Armin	2
50.	Topic 30. Practical lesson 50. Means affecting the efferent nervous system. Means acting on cholinergic processes. Cholinergic blockers (cholinolytics) m-Cholinoblockers: Atropine sulfate, Scopolamine hydrobromide, Platyphylline hydrotartrate n-Cholinoblockers: Pachycarpine hydroiodide, Hexamethonium benzosulfonate	2
51.	Topic 31. Practical lesson 51.	2

	Means acting mainly on adrenergic processes. Adrenomimetics: Epinephrine, Norepinephrine, Phenylephrine hydrochloride, Ephedrine hydrochloride, Naphazoline nitrate, Clonidine hydrochloride, Salbutamol Adrenoblockers (adrenolytics): Propranolol hydrochloride, Atenolol	
52.	Topic 32. Practical lesson 52. Cardiotonic means. Cardiac glycosides: Digoxin Non-glycoside cardiotonic drugs: dopamine, dobutamine, amrinone Solving situational and test tasks on the pharmaceutical analysis of Agents that stimulate receptors of afferent nerve fibers, Agents that affect the efferent nervous system, Agents that act mainly on adrenergic processes, Cardiotonic agents.	2
53.	Topic 33. Practical lesson 53. Antiarrhythmic drugs. Procainamide hydrochloride, Amiodarone	2
54.	Topic 34-35. Practical lesson 54. Means that improve blood supply to organs and tissues. Nitrovasodilators: Glycerin trinitrate solution, Pentaerythritol tetranitrate, Erinit	2
55.	Topic 36. Practical lesson 55. Antagonists of calcium ions. Nifedipine, Verapamil hydrochloride, Amlodipine Activators of potassium channels. Minoxidil, Diazoxide	2
56.	Topic 37. Practical lesson 56. Agents affecting the renin-angiotensin system. Hypotensive (antihypertensive) drugs. Angiotensin-converting enzyme (ACE) inhibitors: Captopril, Enalapril maleate Antispasmodics: Papaverine hydrochloride, Drotaverine hydrochloride, Dibazol Laboratory work: Analysis of Dibazol hydrochloride.	2
57.	Topic 38. Practical lesson 57. Hypertensive drugs. Adrenaline tartrate, norepinephrine hydrotartrate, mesaton	2
58.	Topic 39-40. Practical lesson 58. Angioprotectors. Antioxidants. Ascorbic acid, Rutin, Nicotinic acid, Tocopherol acetate, Retinol acetate Laboratory work: Analysis of ascorbic acid.	2
59.	Topic 28-40. Practical lesson 59. Solving situational and test tasks on the pharmaceutical analysis of antiarrhythmic agents, agents that improve blood supply to organs and tissues, calcium ion antagonists, agents affecting the renin-angiotensin system, hypotensive (antihypertensive) agents, hypertensive agents, angioprotectors, and antioxidants.	2
60.	Topic 41. Practical lesson 60. Hypolipidemic agents. Antiatherosclerotic drugs. Lovastatin, Simvastatin, Atorvastatin.	2
61.	Topic 42. Practical lesson 61. Diuretics. Saluretics: chlorothiazide, hydrochlorothiazide, furosemide, indapamide, ethacrynic acid	2

	Aldosterone antagonists (potassium sparing): Spironolactone	
62.	Topic 42. Practical lesson 62. Diuretics. Osmotic diuretics: Potassium acetate, Mannitol, Urea, Ammonium chloride Diuretics - xanthine derivatives: Euphylline, Theophylline, Theobromine Laboratory work: Analysis of Euphilin solution 2.4%.	2
63.	Topic 43. Practical lesson 63. Agents affecting platelet aggregation and blood coagulation. Antiplatelet agents: Acetylsalicylic acid Anticoagulants: Neodicumarin, Heparin	2
64.	Topic 43. Practical lesson 64. Agents affecting platelet aggregation and blood coagulation. Hemostatics: Vikasol Antifibrinolytics: Aminocaproic acid Laboratory work: Analysis of acetylsalicylic acid.	2
65.	Topic 41-43. Practical lesson 65. Solving situational and test tasks on the pharmaceutical analysis of hypolipidemic agents, antiatherosclerotic agents, diuretic agents, agents affecting platelet aggregation and blood coagulation.	2
66.	Topic 44. Practical lesson 66. Antiseptic and disinfectants. Halogens and halogen-containing products: Chloramine, Iodine, Alcohol iodine solution 5, 10%, Triiodomethane (Iodoform). Oxidizing agents: Hydrogen peroxide solution 3.30%, Potassium permanganate Laboratory work: Analysis of hydrogen peroxide solution 3%	2
67.	Topic 44. Practical lesson 67. Antiseptic and disinfectants. Acids and bases: Benzoic acid, Salicylic acid, Boric acid, Sodium tetraborate. Aldehydes: Formaldehyde solution 35% Alcohols: Ethanol 96% Laboratory work: Analysis of the substance Benzoic acid	2
68.	Topic 44. Practical lesson 68. Antiseptic and disinfectants. Salts of heavy metals: Argentum nitrate, Copper sulfate pentahydrate, Zinc oxide, Zinc sulfate heptahydrate Phenols: Phenol, Resorcinol, Phenylsalicylate Dyes: Ethacridine lactate Laboratory work: Analysis of the substance Cuprum sulfate pentahydrate	2
69.	Topic 44. Practical lesson 69. Solving situational and test tasks on the pharmaceutical analysis of antiseptics and disinfectants. Laboratory work: Analysis of the substance Resorcinol	2
70.	Topic 45. Practical lesson 70. Antibiotics of heterocyclic structure. β -lactamase inhibitors. Penicillins. Cephalosporins.	2
71.	Topic 46. Practical lesson 71. Tetracycline and macrolide antibiotics, aromatic series. Tetracyclines. Macrolides: Erythromycin. Antibiotics of the aromatic series: Levomycetin, Levomycetin stearate, Levomycetin succinate soluble.	2
72.	Topic 47-48. Practical lesson 72.	2

	<p>Antibiotics of the aminoglycoside structure, amphenicols, other groups of antibiotics.</p> <p>Lincomycins. Antibiotics - aminoglycosides: Streptomycin sulfate, Kanamycin monosulfate, Gentamicin sulfate</p> <p>Derivatives of 8-oxyquinoline and nitrofuran.</p> <p>Derivatives of 8-hydroxyquinoline: Nitroxoline</p> <p>Nitrofuran derivatives: Nitrofurural, Nitrofurantoin, Furazolidone</p> <p>Laboratory work: Analysis of Nitrofurural substance</p>	
73.	<p>Topic 49. Practical lesson 73.</p> <p>Derivatives of sulfanilic acid amides. General characteristics.</p> <p>Sulfanilamides: Sulfanilamide, Sodium Sulfacetamide (Albucid), Sulphathiazole (Norsulfasol), Phthalylsulfathiazole (Fthalazol)</p>	2
74.	<p>Topic 50. Practical lesson 74.</p> <p>Antituberculosis drugs</p> <p>Derivatives of isonicotinic acid hydrazide: Isoniazid, Phtivazid</p> <p>Derivatives of p-aminosalicylic acid: Sodium paraaminosalicylate</p> <p>Laboratory work: Analysis of Isoniazid.</p>	2
75.	<p>Topic 45-51. Practical lesson 75.</p> <p>Derivatives of naphthyridine and quinolonecarboxylic acids.</p> <p>Ofloxacin, Norfloxacin, Ciprofloxacin hydrochloride, Lomefloxacin hydrochloride.</p> <p>Solving situational and test tasks on the pharmaceutical analysis of Antibiotics, 8-hydroxyquinoline derivatives, Nitrofuran derivatives, Sulfanilamides, Antituberculosis drugs.</p>	2
76.	<p>Topic 60. Practical lesson 76.</p> <p>Medicines for thyroid hormones, antithyroid drugs.</p> <p>Thyroid hormone preparations: thyroxine, triiodothyronine, thyroidin.</p> <p>Medicines used for hypofunction of the thyroid gland: potassium iodide.</p> <p>Antithyroid drugs: iodine, diiodotyrosine, mercazolil (thiamazole).</p>	2
77.	<p>Topic 60. Practical lesson 77.</p> <p>Laboratory work: Analysis of the substance Potassium iodide.</p>	2
78.	<p>Topic 61. Practical lesson 78.</p> <p>Pancreatic hormone drugs. Insulin.</p> <p>Insulin preparations: Insulin for injection, Suinsulin, Zinc-insulin suspension for injection.</p>	2
79.	<p>Topic 62. Practical lesson 79.</p> <p>Antidiabetic drugs. Derivatives of sulfonylureas: Butamide, Chlorpropamide, Bucarban, Glibenclamide</p> <p>Biguanides: Metformin hydrochloride, Buformin</p>	2
80.	<p>Topic 60-62. Practical lesson 80.</p> <p>Solving situational and test tasks on pharmaceutical analysis of thyroid hormone drugs, antithyroid drugs, pancreatic hormone drugs, and antidiabetic drugs.</p>	2
81.	<p>Topic 63. Practical lesson 81.</p> <p>Steroid hormones and their analogues. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.</p>	2
82.	<p>Topic 63. Practical lesson 82.</p> <p>Hormones of the adrenal cortex and their synthetic analogues. Corticosteroids.</p> <p>Mineralocorticosteroids: Deoxycorticosterone acetate.</p> <p>Glucocorticosteroids: Cortisone acetate, Hydrocortisone acetate.</p>	2

	Synthetic analogues of glucocorticosteroids: Prednisone, Dexamethasone, Triamcinolone, Flumethasone pivalate Laboratory work: Analysis of Tabulettae Prednisoloni 0.005.	
83.	Topic 63. Practical lesson 83. Laboratory work: Analysis of Prednisolone tab. 5 mg.	2
84.	Topic 63. Practical lesson 84. Laboratory work: Analysis of cortisone acetate tab. 25 mg.	2
85.	Topic 64. Practical lesson 85. Androgens, anabolic steroids and their analogues. Testosterone propionate, Methyltestosterone Semi-synthetic and synthetic anabolic agents: Methandienone, Nandrolone phenylpropionate.	2
86.	Topic 65. Practical class 86. Progestogens, estrogens. Birth control. Estrogens of nonsteroidal structure. Estrogenic hormones: Estradiol dipropionate, Estradiol dipropionate Estrogens of nonsteroidal structure: Sinestrol, Diethylstilbestrol. Progestogenic hormones: Progesterone, Pregnin	2
87.	Topic 65. Practical lesson 87. Laboratory work: Analysis of Sinestrol solution p/in., oil. 2% 1 ml.	2
88.	Topic 63-65. Practical lesson 88. Solving situational and test tasks on the pharmaceutical analysis of steroid hormones and their analogues.	2
89.	Topic 66. Practical lesson 89. Vitamins are water soluble. Part 1. Ascorbic acid, Calcium pangamate, Calcium pantothenate, Nicotinic acid, Nicotinamide.	2
90.	Topic 66. Practical lesson 90. Laboratory work: Analysis of the substance Ascorbic acid.	2
91.	Topic 66. Practical lesson 91. Vitamins are water soluble. Part 2. Pyridoxine hydrochloride, Thiamine hydrobromide and hydrochloride, Folic acid, Riboflavin, Rutin.	2
92.	Topic 66. Practical lesson 92. Laboratory work: Analysis of Thiamine hydrochloride solution d/in. 50 mg/ml 1 ml.	2
93.	Topic 66. Practical lesson 93. Laboratory work: Analysis of pyridoxine hydrochloride solution d/in. 50 mg/ml 1 ml.	2
94.	Topic 67. Practical lesson 94. Fat-soluble vitamins. Retinol acetate, Ergocalciferol, Tocopherol acetate, Vikasol.	2
95.	Topic 66-67. Practical lesson 95. Solving situational and test tasks on the pharmaceutical analysis of Vitamins.	2
<i>The number of hours of practical lessons in the discipline</i>		190

6. Independent work of a student of higher education

№	Title of the topic / types of tasks	Number of hours
1.	The subject and tasks of pharmaceutical chemistry. The system of evaluation of the quality of medicinal products. Stability of the composition as a necessary condition for all stages of the existence of the medicinal product. Peculiarities of pharmaceutical analysis are related to the intended use of drugs and the professional responsibility of the pharmacist. Pharmacopoeial analysis	2

2.	Analysis of the physicochemical properties of medicinal products as one of the elements of the quality assessment of medicinal products.	2
3.	The use of spectroscopic and chromatographic methods in the identification of medicinal products; peculiarities of using standard samples of medicinal substances and standard spectra.	3
4.	Identification of medicinal substances of inorganic nature	2
5.	Identification of medicinal substances of organic nature by functional groups (functional analysis).	3
6.	Reasons for changes in the structure of the medicinal substance (influence of light, moisture, temperature and other factors. The nature and character of impurities, methods of their detection.	2
7.	Methods of quantitative analysis of the content of medicinal products. Gravimetry.	2
8.	Titrimetric methods of drug analysis.	0,5
9	Titrimetric methods of analysis: method of acid-base titration in aqueous and non-aqueous media, argentometry, complexometry.	0,5
10.	Optical methods in quantitative analysis: refractometry, polarimetry, UV and IR spectrophotometry, photometry in the visible spectrum.	3
11.	Chromatographic methods. Methods based on thermodynamic properties of substances. Combination of extraction, chromatographic and optical methods in the analysis of dosage forms.	3
12.	Express analysis of medicines. Modern trends in the development of pharmaceutical analysis.	1
13.	Modern strategies for creating innovative medicines.	4
14.	Organic synthesis is the basis for obtaining synthetic small molecules. Combinatorial synthesis and its role in drug design. Strategy for the development and synthesis of libraries of chemical compounds. Prospects for the development of combinatorial synthesis.	2
15.	Stages of creation of medicines - "from molecule to drug".	3
16.	Principles of classification of medicinal products, their nomenclature. Structure-activity relationship in the creation and analysis of medicinal products.	2
17.	The main ways of drug metabolism. Chemical reactions that underlie metabolic transformations. Phases of metabolism. Factors affecting metabolic processes. Prodrugs	2
18.	Nonsteroidal anti-inflammatory drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of obtaining, methods of analysis, application in medicine.	2
19.	Narcotic analgesics and their analogues. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of obtaining, methods of analysis, application in medicine.	2
20.	Sleep aids. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine. means	2
21.	Means for anesthesia. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action,	2

	methods of preparation, methods of analysis, application in medicine.	
22.	Psychotropic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
23.	Psychotropic drugs. Part 2. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine	2
24.	Psychotropic drugs. Part 3 Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
25.	Anticonvulsant and antiepileptic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
26.	Means for the treatment of parkinsonism. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
27.	Emetics and antiemetics. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
28.	Means for the treatment of cough. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
29.	Nootropic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine	2
30.	Antihistamines. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
31.	Agents affecting the afferent nervous system. Means that stimulate receptors of afferent nerve fibers. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	1
32.	Means that reduce the sensitivity of afferent nerve fibers. Means for local anesthesia. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	1
33.	Means affecting the efferent nervous system. Means acting on cholinergic processes. Part 1. Characteristics, classification, re-	0,5

	relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	
34.	Means acting on cholinergic processes. Part 2. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	0,5
35.	Means acting mainly on adrenergic processes. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	1
36.	Cardiotonic means. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	1
37.	Antiarrhythmic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	1
38.	Means that improve blood supply to organs and tissues. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	1
39.	Peripheral vasodilators. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	1
40.	Antagonists of calcium ions. Activators of potassium channels. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	1
41.	Agents affecting the renin-angiotensin system. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	1
42.	Hypotensive (antihypertensive) drugs. Hypertensive drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	1
43.	Angioprotectors. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	1
44.	Antioxidants. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	1
45.	Hypolipidemic agents. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine	0,5

46.	Diuretics. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	1
47.	Agents affecting platelet aggregation and blood coagulation. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	0,5
48.	Antibiotics of heterocyclic structure. b-lactamase inhibitors. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	1
49.	Tetracycline and macrolide antibiotics. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	1
50.	Antibiotics of the aminoglycoside structure, amphenicols, other groups of antibiotics. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	1
51.	Sulfanilamides. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	1
52.	Derivatives of naphthyridine and quinolonecarboxylic acids. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	1
53.	Derivatives of 8-oxyquinoline, quinoxaline and nitrofurantoin. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	1
54.	Antitubercular drugs. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	1
55.	Medicinal products used for the treatment of oncological diseases (alkaloids, antibiotics, hormonal agents and their antagonists, other groups). Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
56.	Examples of "targeted" anticancer drugs (drugs of different chemical groups). Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
57.	Antiviral means. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
58.	Antimalarial drugs. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2

59.	Medicines for the treatment of protozoan infections. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
60.	Anthelmintics. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
61.	Antifungal drugs. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
62.	Antipediculosis and acaricidal means. Characteristics, classification, methods of preparation, methods of analysis, application in medicine.	2
63.	Antiseptic and disinfectants Characteristics, classification, mechanism of action, methods of preparation, methods of analysis, application in medicine.	1
64.	Medicines for thyroid hormones, antithyroid drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
65.	Medicines for pancreatic hormones, Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine	2
66.	Antidiabetic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
67.	Steroid hormones and their analogues. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine	2
68.	Corticosteroids. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine	2
69.	Androgens, anabolic steroids and their analogues. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine	2
70.	Progestogens, estrogens. Birth control. Estrogens of nonsteroidal structure. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine	2
71.	Vitamins are water soluble. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
72.	Fat-soluble vitamins. Characteristics, classification, relationship between structure and pharmacological action,	2

	mechanism of action, methods of preparation, methods of analysis, application in medicine.	
73.	Medicinal products affecting immunity processes (immunotropic agents). Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
74.	Anorexigenic means. Means for the treatment of alcoholism. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
75.	Anti-ulcer drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
76.	Sorbents, antidotes and complexons. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
77.	Radiopaque and other diagnostic tools. Characteristics, classification, mechanism of action, methods of preparation, methods of analysis, application in medicine.	2
Total		130

7. Teaching methods

Practical lessons: conversation, solution of situational problems, control of knowledge, abilities and skills of higher education students, presentation of a general problem by the teacher and its discussion with the participation of higher education students, performance of control tasks, their verification, evaluation. Performance of laboratory work, in which students of higher education under the guidance of a teacher conduct educational experiments in specially equipped educational laboratories using equipment adapted to the conditions of the educational process.

Independent work: independent work with the recommended main and additional literature, with electronic information resources, independent work with the bank of test tasks STEP-2.

8. Forms of control and assessment methods (including criteria for evaluating learning outcomes)

Current control: testing, oral survey, problem solving.

Final control: exam.

1. Assessment of the current educational activity in a practical session:

1. Assessment of theoretical knowledge on the topic of the lesson:
 - methods: survey, testing, solving a situational problem
 - maximum score – 5, minimum score – 3, unsatisfactory score – 2.
2. Assessment of practical skills on the subject of the lesson:
 - methods: assessment of the correctness of the performance of practical skills
 - maximum score – 5, minimum score – 3, unsatisfactory score – 2.

The grade for one practical lesson is the arithmetic average of all components and can only have an integer value (5, 4, 3, 2), which is rounded according to the statistical method.

Criteria for current assessment in a practical lesson

Assessment	Assessment criteria
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«5»	The applicant actively participates in the discussion of the most difficult questions on the topic of the lesson, gives at least 90% correct answers to standardized test tasks, answers written tasks without errors, performs practical work and draws up a protocol.
«4»	The applicant participates in the discussion of the most difficult questions on the topic, gives at least 75% correct answers to standardized test tasks, makes some minor mistakes in the answers to written tasks, performs practical work and draws up a protocol.
«3»	The applicant participates in the discussion of the most difficult questions on the topic, gives at least 60% correct answers to standardized test tasks, makes significant mistakes in answers to written tasks, performs practical work and draws up a protocol.
«2»	The applicant does not participate in the discussion of complex questions on the topic, gives less than 60% correct answers to standardized test tasks, makes gross mistakes in answers to written tasks or does not give answers to them at all, does not perform practical work and does not draw up a protocol.

Only those applicants who have fulfilled the requirements of the training program in the discipline, have no academic debt, their average score for the current educational activity in the discipline is at least 3.00, and they have passed the test control based on the tests "STEP-2" are admitted to the final control in the form of an exam. - 2" at least 90% (50 tasks).

The test control is conducted in the Educational and Production Complex of Innovative Technologies of Learning, Informatization and Internal Monitoring of the Quality of Education of the University in the last class before the exam.

Assessment of the results of the students' training during the final control – exam.

Content of assessed activity	Scores
The answer to a theoretical question	2
The answer to a theoretical question	2
Solution of the calculation problem	1

Criteria for assessment the results of the students' training during final control - exam

Assessment	Assessment criteria
Perfectly «5»	The applicant worked systematically during the semester, showed during the exam versatile and in-depth knowledge of the program material, is able to successfully perform the tasks provided for in the program, mastered the content of the main and additional literature, realized the relationship of individual sections of the discipline, their importance for the future profession, showed creative abilities in understanding and using educational program material, demonstrated the ability to independently update and replenish knowledge; the level of competence is high (creative).
Good «4»	The applicant has demonstrated complete knowledge of the educational program material, successfully performs the tasks provided for by the program, has mastered the basic literature recommended by the program, has shown a sufficient level of knowledge in the discipline and is capable of their independent updating and renewal in the course of further education and professional activity; the level of competence is sufficient (constructive and variable).
Satisfactorily «3»	The applicant who has demonstrated knowledge of the main curriculum material in the amount necessary for further education and subsequent work in the profession, copes with the tasks provided for by the program,

	made some mistakes in the answers on the exam and when completing the exam tasks, but has the necessary knowledge to overcome the mistakes made mistakes under the guidance of a scientific and pedagogical worker; level of competence - average (reproductive).
Unsatisfactorily «2»	The applicant did not demonstrate sufficient knowledge of the main educational program material, made fundamental mistakes in the performance of tasks provided for by the program, cannot use the knowledge in further studies without the help of a teacher, did not manage to master the skills of independent work; the level of competence is low (receptive-productive).

9. Distribution of points received by higher education applicants

The obtained average score for the academic discipline for applicants who successfully mastered the work program of the academic discipline is converted from a traditional four-point scale to points on a 200-point scale, as shown in the table:

Conversion table of a traditional assessment into a multi-point scale

Traditional four-point scale	Multipoint 200-point scale
Perfectly («5»)	185 – 200
Good («4»)	151 – 184
Satisfactorily («3»)	120 – 150
Unsatisfactorily («2»)	Less than 120

A multi-point scale (200-point scale) characterizes the actual success of each applicant in mastering the educational component. The conversion of a traditional assessment (average score for an academic discipline) into a 200-point one is performed by the information and technical department of the University.

According to the obtained points on a 200-point scale, the achievements of the applicants are evaluated according to the ECTS rating scale. Further ranking according to the ECTS rating scale makes it possible to evaluate the achievements of students in the educational component who are studying in the same course of the same specialty, in accordance with the points they received.

The ECTS scale is a relative-comparative rating, which establishes the applicant's belonging to the group of better or worse among the reference group of fellow students (faculty, specialty). An "A" grade on the ECTS scale cannot be equal to an "perfectly" grade, a "B" grade to a "good" grade, etc. When converting from a multi-point scale, the limits of grades "A", "B", "C", "D", "E" according to the ECTS scale do not coincide with the limits of grades "5", "4", "3" according to the traditional scale. Acquirers who have received grades of "FX" and "F" ("2") are not included in the list of ranked acquirers. The grade "FX" is awarded to students who have obtained the minimum number of points for the current learning activity, but who have not passed the final examination. A grade of "F" is given to students who attended all lessons in the discipline, but did not receive an average score (3.00) for the current academic activity and were not admitted to the final examination.

Applicants who study on one course (one specialty), based on the number of points scored in the discipline, are ranked on the ECTS scale as follows:

Conversion of the traditional grade from the discipline and the sum of points on the ECTS scale

Assessment on the ECTS scale	Statistical indicator
A	Top 10% students
B	The next 25% students
C	The next 25% students
D	The next 25% students

10. Methodical support:

- Working program of the academic discipline
- Syllabus of the academic discipline
- Textbooks:
- Multimedia presentations
- Situational tasks
- Methodical development of practical lessons
- Electronic bank of test tasks by subdivisions of the discipline.

11. Questions for preparing for the final control

1. Structure of the State Pharmacopoeia of Ukraine. The system of evaluation of the quality of medicinal products.
2. Structure of the monograph. The difference between the pharmacopoeial requirements and the norms and methods of analysis for chemical, etc. products manufactured in accordance with State Standards (DSTU) and technical conditions (TC).
3. Peculiarities of pharmaceutical analysis are related to the intended use of drugs and the professional responsibility of the pharmacist. The relevance of the requirements and methods of quality assessment depends on the pharmacological effect of the drug (purpose, dosage, method of administration), the method of production, the presence of auxiliary and concomitant substances in the medicinal form.
4. Unification and standardization of similar tests in groups of medicinal substances. General provisions, general articles and monographs of the Pharmacopoeia, their relationship.
5. Analysis of the physicochemical properties of medicinal products as one of the elements of the quality assessment of medicinal products. Organoleptic analysis, evaluation of drug solubility as a general indicative characteristic of the tested substance. Use of physical constants (relative density, viscosity, boiling/melting point, solidification) in drug testing.
6. Analysis of the physical and chemical properties of drugs as one of the elements of their quality assessment. The use of such physical constants as the index of refraction, optical rotation in drug tests.
7. Use of spectroscopic and chromatographic methods in the identification of medicinal products; peculiarities of using standard samples of medicinal substances and standard spectra. IR, UV spectrophotometry, NMR spectroscopy.
8. Use of spectroscopic and chromatographic methods in the identification of medicinal products; peculiarities of using standard samples of medicinal substances and standard spectra. Mass spectrometry (MS); high performance liquid chromatography; thin layer chromatography.
9. Identification of medicinal substances of inorganic nature. Identification reactions of aluminum, ammonium, potassium, sodium, calcium, magnesium, zinc and iron cations (II, III).
10. Identification of medicinal substances of inorganic nature. Identification reactions of stibium, bismuth, mercury, silver, arsenic, and lead cations.
11. Identification of medicinal substances of inorganic nature. Identification reactions of chlorine, bromine, iodine anions.
12. Identification of medicinal substances of inorganic nature. Identification reactions of sulfates, sulfites, nitrates, nitrites, phosphates, carbonates, hydrocarbons.
13. Identification of medicinal substances of organic nature by functional groups (functional analysis). Identification reactions of primary alcohols, polyatomic alcohols, secondary alcohols, phenols.
14. Identification of medicinal substances of organic nature by functional groups (functional analysis). Identification reactions of aldehydes, ketones, carboxylic acids, amides.

15. Identification of medicinal substances of organic nature by functional groups (functional analysis). Reactions for the identification of a double bond, covalently bonded atoms of halogens, ethers, esters.
16. Identification of medicinal substances of organic nature by functional groups (functional analysis). Identification reactions of primary, secondary and tertiary aromatic amines.
17. Identification of medicinal substances of organic nature by functional groups (functional analysis). Identification reactions of primary, secondary and tertiary aliphatic amines and primary, secondary aliphatic nitro compounds. Identification reactions of aromatic nitro compounds.
18. Reasons causing a change in the structure of the medicinal substance (influence of light, moisture, temperature and other factors foreseen by the conditions and terms of storage). The influence of impurities on the qualitative and quantitative composition of the medicinal product and the possibility of changing its pharmacological activity (specific and general impurities).
19. Nature and nature of impurities, methods of their detection. Production impurities, semi-finished products, raw materials. Unification of tests.
20. General provisions for determining the content of impurities according to the indicators "transparency, turbidity" and "color" of the solution, etc. Approaches to establishing the limits of permissible impurities based on the degree of sensitivity of chemical reactions. Standard solutions.
21. Testing for impurities of inorganic ions. Conditions and chemistry of reactions for the detection of ammonium and arsenic ions.
22. Testing for impurities of inorganic ions. Conditions and chemistry of the reactions for the detection of potassium, calcium and magnesium ions.
23. Testing for impurities of inorganic ions. Conditions and chemistry of reactions for the detection of ions of iron, aluminum, zinc and heavy metals.
24. Testing for impurities of inorganic ions. Conditions and chemistry of reactions for the detection of chlorides, fluorides, sulfates, and phosphates.
25. Production and properties, purity research, conditions and terms of storage of purified water, highly purified water and water for injections.
26. Methods of quantitative analysis of the content of medicinal products. The choice of a method that allows you to evaluate the content of a medicinal substance by functional groups characterizing its properties. Peculiarities of quantitative determination of individual substances and dosage forms. Validation of analytical methods.
27. Methods of quantitative analysis of the content of medicinal products. Relative specificity, sensitivity, correctness (accuracy) and reproducibility of the method. Comparative assessment of the suitability of modern chemical and physicochemical methods for quantitative determination of the active substance.
28. Methods of quantitative analysis of the content of medicinal products. The influence of the polyfunctionality of medicinal substances on the choice of the method of quantitative determination. Weight analysis (gravimetry).
29. Methods of quantitative analysis of the content of medicinal products. The influence of the polyfunctionality of medicinal substances on the choice of the method of quantitative determination. Determination of nitrogen in organic compounds after mineralization (Kjeldahl method).
30. Titrimetric methods of analysis. Method of acid-base titration in aqueous and non-aqueous media.
31. Titrimetric methods of analysis. Argentometry, complexometry.
32. Titrimetric methods of analysis. Mercurimetry, permanganatometry, bromatometry.
33. Titrimetric methods of analysis. Iodometry, iodatometry, cerimetry.
34. Titrimetric methods of analysis. Dichromatometry, nitritometry. Potentiometric titration.
35. Optical methods in quantitative analysis. Refractometry, polarimetry.
36. Optical methods in quantitative analysis. UV and IR spectrophotometry, photometry in the visible region of the spectrum.

37. Chromatographic methods: gas-liquid chromatography (GC) and high-performance liquid chromatography (HPLC), electrophoresis.
38. Methods based on thermodynamic properties of substances: thermographic methods, phase solubility method. Combination of extraction, chromatographic and optical methods in the analysis of dosage forms.
39. Express analysis of medicines. Modern trends in the development of pharmaceutical analysis.
40. Modern strategies for creating innovative medicines. Sources of new medicinal products. Leader compounds, methods of their optimization.
41. Organic synthesis is the basis for obtaining synthetic small molecules. Combinatorial synthesis and its role in drug design. Strategy for the development and synthesis of libraries of chemical compounds. Prospects for the development of combinatorial synthesis.
42. Stages of creation of medicines - "from molecule to drug".
43. Basic aspects of the chemical interaction of drugs, their transformation and metabolism. Phases of metabolism.
44. Mechanisms of action of medicines and methods of their research.
45. Means for anesthesia. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
46. Sleep aids. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
47. Psychotropic drugs Neuroleptics. Tranquilizers Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
48. Psychotropic drugs. Antidepressants Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples
49. Psychotropic drugs. Analeptics Sedatives Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
50. Means for the treatment of parkinsonism. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
51. Narcotic analgesics and their analogues. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
52. Emetics and antiemetics. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
53. Means for the treatment of cough. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
54. Nootropic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
55. Nonsteroidal anti-inflammatory drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
56. Means that reduce the sensitivity of afferent nerve fibers. Means for local anesthesia. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
57. Means acting on cholinergic processes. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
58. Means acting mainly on adrenergic processes. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
59. Antihistamines. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
60. Means that stimulate receptors of afferent nerve fibers. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
61. Cardiotonic means. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
62. Antiarrhythmic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.

63. Means that improve blood supply to organs and tissues. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
64. Peripheral vasodilators. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
65. Antagonists of calcium ions. Activators of potassium channels. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples
66. Angioprotectors. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples
67. Agents affecting the renin-angiotensin system Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
68. Hypotensive (antihypertensive) drugs. Hypertensive drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
69. Hypolipidemic means. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
70. Agents affecting platelet aggregation and blood coagulation. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
71. Diuretics. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
72. Medicinal products for thyroid hormones, antithyroid drugs. Medicines for pancreatic hormones, Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples
73. Antidiabetic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples
74. Sex hormones, androgens, anabolic steroids and their analogues. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples
75. Sex hormones, progestogens, estrogens. Birth control. Estrogens of nonsteroidal structure Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples
76. Corticosteroids. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples
77. Vitamins. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples
78. Beta-lactam antibiotics. b-lactamase inhibitors. Characteristics, classification, relationship between structure and action, mechanism of action, examples.
79. Tetracycline and macrolide antibiotics. Characteristics, classification, relationship between structure and action, mechanism of action, examples.
80. Antibiotics of the aminoglycoside structure, amphenicols, other groups of antibiotics. Characteristics, classification, relationship between structure and action, mechanism of action, examples.
81. Sulfanilamides. Characteristics, classification, relationship between structure and action, mechanism of action, examples
82. Derivatives of naphthyridine and quinolonecarboxylic acids. Characteristics, classification, relationship between structure and action, mechanism of action, examples.
83. Derivatives of 8-oxyquinoline, quinoxaline and nitrofural. Characteristics, classification, relationship between structure and action, mechanism of action, examples.
84. Anti-tuberculosis drugs. Characteristics, classification, relationship between structure and action, mechanism of action, examples.
85. Antiviral means. Characteristics, classification, relationship between structure and action, mechanism of action, examples.
86. Medicines for the treatment of protozoan infections. Characteristics, classification, relationship between structure and action, mechanism of action, examples.

87. Anthelmintics. Characteristics, classification, relationship between structure and action, mechanism of action, examples.
88. Antifungal drugs. Characteristics, classification, relationship between structure and action, mechanism of action, examples.
89. Medicinal products used for the treatment of oncological diseases (Alkylating agents, Antimetabolites). Characteristics, classification, relationship between structure and action, mechanism of action, examples.
90. Medicinal products used for the treatment of oncological diseases (alkaloids, antibiotics, hormonal agents and their antagonists, other groups). Characteristics, classification, relationship between structure and action, mechanism of action, examples.
91. "Targeted" anticancer drugs (drugs of different chemical groups). Characteristics, classification, relationship between structure and action, mechanism of action, examples.
92. Antiseptic, disinfectant and insecticidal agents Characteristics, classification, mechanism of action, relationship between structure and action, examples.
93. Antipediculosis and acaricidal means. Characteristics, classification, relationship between structure and action, examples.
94. Radiopaque and other diagnostic means. Characteristics, classification, mechanism of action, relationship between structure and action, examples.
95. Antioxidants. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, relationship between structure and action, examples.
96. Medicinal products affecting immunity processes (immunotropic agents). Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
97. Anorexigenic means. Means for the treatment of alcoholism. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.
98. Sorbents, antidotes and complexons. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, examples.

12. Recommended literature

Basic:

1. Handbook of pharmaceutical chemistry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. European Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. 1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.

3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянц, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

13. Information resources

1. Materials in the information system of ONMedU
https://info.odmu.edu.ua/chair/pharmaceutical_chemistry/files/214/ua
2. [Компендіум - лікарські препарати](#)
3. [European Pharmacopoeia \(Ph. Eur.\)](#)
4. [DrugBank онлайн](#)