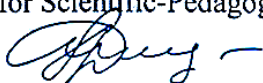


National Pirogov Memorial Medical University, Vinnytsya

“APPROVED”

Vice-rector of a Higher Education Institution
for Scientific-Pedagogical and Educational
Affair



Prof. of HEI Oksana
SEREBRENNIKOVA

“ 02 ” 09 20 22 year

“ AGREED ”

Head of the Pharmaceutical Chemistry
Department



Assoc. prof. of HEI Tetiana
YUSHCHENKO

“ 02 ” 09 2022 year

**SYLLABUS
of academic discipline
Pharmaceutical chemistry**

Specialty	226 Pharmacy, Industrial Pharmacy
Educational level	the second (master's) level
Educational programme	EPP "Pharmacy", 2022
Academic year	2022-2023
Department	Pharmaceutical Chemistry Department
Lecturer	Assoc. prof. of HEI Olexandra DAVYDENKO, assoc. prof. of HEI Yuliia SHEPETA, as. Kateryna STEPANYUK
Contact information	pharmchem@vnm.edu.ua, Pirogov str., 56, tel. 55-39- 54
Syllabus compiler	Assoc. prof. of HEI Yuliia SHEPETA

1. Status and structure of the discipline

Discipline status	Compulsory
Discipline code in EPP/ discipline place in EPP	CC 19/discipline of professional training
Course / semester	3rd, 4th, 5th years (V, VI, VII, VIII, IX semesters)
The amount of discipline (the total number of hours / number of credits ECTS)	390 hours / 13 credits ECTS
The structure of the discipline	Lectures 36 hours Practical classes 188 hours Independent work 166 hours
Language of study	English
Form of study	Full - time , part-time (<i>or remote by order</i>)

2. Description of the discipline

Short annotation of the course, relevance. The discipline "Pharmaceutical Chemistry" belongs to the obligatory disciplines of the cycle of professionally-oriented training of specialists in the specialty 226 Pharmacy, industrial pharmacy. The study of the discipline is aimed at deepening the knowledge gained in other general disciplines of chemical profile, in the context of the properties of drugs, learning methods for their obtaining, methods of analysis and quality control of drugs and dosage forms, structure and activity relationship (SAR-analysis).

Prerequisites: basic knowledge in such disciplines as general and inorganic chemistry, organic chemistry, analytical chemistry, physical and colloid chemistry, microbiology, pharmacognosy, pharmacology, drug technology is necessary for successful learning of the discipline and for achievement of program results.

The purpose of the course and its significance for professional activities. The aim of the course is providing students with the necessary theoretical knowledge about the properties of drugs, their classification, the relationships of biological activity of compounds and their structure, as well as the formation of important professional skills and abilities to obtain drugs and carrying out quality control. The main objectives of the discipline "Pharmaceutical Chemistry" are formation of knowledge about the structure of drugs and the main properties, methods of quality control, including in accordance with the requirements of regulatory documentation; provide an understanding of the principles of creation (obtaining) of drugs; reasonable usage of chemical and physic and chemical methods of analysis for identification, purity tests, quantitative determination (assay) of drugs.

Mastering of the discipline will allow students to acquire, in addition to integral, the following competencies:

General (GC): GC 2, GC 4, GC 6, GC 11, GC 12.

Special (professional): PC 4, PC 7, PC 12, PC 19, PC 20.

Postrequisites. The knowledge and skills acquired during the studying of the discipline are necessary for further studying such disciplines as standardization of medicines, quality control of

medicines, and allow future professionals, pharmaceutical workers to adequately dissolve complex professional problems (in regards to obtaining medicinal compounds, quality assurance, proper storage conditions, rational use of medicines).

3. Learning outcomes.

The results of mastering of the discipline are:

- studying of international non-proprietary names of medicinal substances;
- studying of methods of obtaining medicinal substances;
- mastering the methods of qualitative and quantitative analysis of drugs, and their purity assessment;
- studying of the ways of drug metabolism;
- ability to determine the optimal conditions for storage of drugs;
- ability to use analytical documentation that regulates the quality of drugs (State Pharmacopoeia, International Pharmacopoeia, national and regional pharmacopoeias, MQC, relevant orders and instructions), methodical guidelines for the implementation of methods of quality control of substances and drugs;
- usage of chemical, physical, physico-chemical methods of quality control of drugs;
- ability to give a qualified assessment of the quality of drugs in accordance with the results of the analysis and the requirements of the MQC and regulations.

4. Content and logistic of the discipline

«Pharmaceutical chemistry»	V, VI, VII, VIII, IX semesters 390 hours / 13 credits	Lectures № 1-18 Practical classes №№ 1-69 Topics for self- study: according to program of discipline
-----------------------------------	-------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------

The course includes 71 topics, which are divided into 5 parts.

Part 1. Pharmaceutical analysis

1. The subject and tasks of pharmaceutical chemistry. System of quality assessment of medicines. Pharmacopoeial analysis.
2. Analysis of physico-chemical properties of medicines as one of the elements of quality assessment of medicines. Appearance, solubility, viscosity, melting point, etc.
3. Reasons which are cause changes in the structure of medicines (influence of light, moisture, temperature and other factors provided by the conditions and terms of storage).
4. Refractometry, polarimetry in pharmaceutical analysis.
5. Usage of spectroscopic and chromatographic methods in pharmaceutical analysis.
6. Nature and character of admixtures, methods of admixtures determination.
7. Identification of medicinal substances of inorganic nature.
8. Elemental analysis.
9. Identification of medicinal substances of organic nature.
10. Identification of medicinal substances of organic nature according to functional groups.

11. Methods of quantitative analysis. Gravimetry.
12. Titrimetric methods of analysis.
13. Express analysis of medicines. Modern trends in the development of pharmaceutical analysis.
14. Express analysis of monocomponent and multicomponent medicines.

Part 2. Chemical bases of the activity of medicines. Medicines which are influence on the CNS

15. Principles of classification of medicines; nomenclature of medicines. Interconnection of structure-activity in the creation and analysis of drugs.
16. The main ways of metabolism of medicines. Chemical reactions of metabolic transformations. Phases of metabolism. Factors which are influence on metabolic processes. Prodrugs.
17. Narcotic analgesics and their analogues. Characteristic, classification, relationship between structure and pharmacological action, mechanism of action, methods of synthesis, methods of analysis, usage in medical practice.
18. Nonsteroid anti-inflammatory drugs. Characteristic, classification, relationship between structure and pharmacological action, mechanism of action, methods of synthesis, methods of analysis, usage in medical practice.
19. Analgesics-antipyretics. Characteristic, classification, relationship between structure and pharmacological action, mechanism of action, methods of synthesis, methods of analysis, usage in medical practice.
20. Hypnotic drugs. Characteristic, classification, relationship between structure and pharmacological action, mechanism of action, methods of synthesis, methods of analysis, usage in medical practice.
21. Medicines for anesthesia. Characteristic, classification, relationship between structure and pharmacological action, mechanism of action, methods of synthesis, methods of analysis, usage in medical practice.
22. Psychotropic drugs. Characteristic, classification, relationship between structure and pharmacological action, mechanism of action, methods of synthesis, methods of analysis, usage in medical practice.
23. Anticonvulsants and antiepileptics. Characteristic, classification, relationship between structure and pharmacological action, mechanism of action, methods of synthesis, methods of analysis, usage in medical practice.
24. Medicines for treatment of Parkinson's disease. Characteristic, classification, relationship between structure and pharmacological action, mechanism of action, methods of synthesis, methods of analysis, usage in medical practice.
25. Emetic and antiemetic medicines. Characteristic, classification, relationship between structure and pharmacological action, mechanism of action, methods of synthesis, methods of analysis, usage in medical practice.
26. Medicines for treatment of cough. Characteristic, classification, relationship between structure and pharmacological action, mechanism of action, methods of synthesis, methods of analysis, usage in medical practice.
27. Nootropic drugs. Characteristic, classification, relationship between structure and pharmacological action, mechanism of action, methods of synthesis, methods of analysis, usage in medical practice.

28. Antihistamines. Characteristic, classification, relationship between structure and pharmacological action, mechanism of action, methods of synthesis, methods of analysis, usage in medical practice.

Part 3. Drugs acting on nervous, cardiovascular, excretory system and blood coagulation system

29. Drugs acting on afferent nervous fibers. Local anaesthetics.

Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.

30. Drugs acting on afferent nervous fibers (antacids, ulcer protectives, astringents).

Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.

31. Drugs acting on efferent nervous fibers. Adrenergic drugs. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.

32. Drugs mainly acting on adrenergic receptors. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.

33. Drugs acting on efferent nervous fibers. Cholinergic drugs. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.

34. Cardiotonic drugs. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.

35. Antiarrhythmic drugs. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.

36. Drugs that improve the blood circulation of organs and tissues. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.

37. Peripheral vasodilators. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.

Calcium channel blockers. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.

38. Drugs acting on renin-angiotensin system. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.

39. Hypotensive and hypertensive drugs. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.

40. Angioprotectors. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.

41. Antioxidants. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.

42. Antihyperlipidaemic agents. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.

43. Diuretics. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.

44. Drugs acting on aggregation of platelets (thrombocytes) and blood coagulation. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.

Part 4. Chemotherapeutics, antiseptics and disinfectants

45. Antibiotics with heterocycled structures. β -lactamase inhibitors. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.
46. Antibiotics-tetracyclines and macrolides. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.
47. Aminoglycosides, inhibitors of protein synthesis (chloramphenicol), other antibiotics. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.
48. Sulphonamides. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.
49. Derivatives of naphthiridine and choline-carbonic acids. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.
50. 8-oxyquinoline, quinoxaline and nitrofurane derivatives. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.
51. Antitubercular agents. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.
52. Antineoplastic agents (alkylating agents, alkaloids, antibiotics, hormones and its antagonists, other groups). Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.
53. Examples of “targeted” anticancer drugs (drugs of different chemical groups). Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.
54. Antiviral agents. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.
55. Antimalarials. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.
56. Antiprotozoals. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.
57. Anthelmintic agents. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.
58. Antifungal agents. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.
59. Anti-pediculosis and acaricides. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.
60. Antiseptics and disinfectants. Characteristics, classification, structure-activity relationship, mode of action, methods of obtaining, methods of analysis, application in medicine.

Part 5. Drugs acting on organ functions, metabolism and immunity

61. Thyroid hormone medications, anti-thyroid drugs. Characteristics, classification, structure-activity relationship, mechanism of action, metabolism, methods of production, methods of analysis, application in medicine.
62. Pancreatic hormone drugs, Characteristics, classification, structure-activity relationship, mechanism of action, metabolism, methods of production, methods of analysis, application in medicine.

63. Antidiabetic drugs. Characteristics, classification, structure-activity relationship, mechanism of action, methods of production, methods of analysis, application in medicine.
64. Steroid hormones and their analogs. Corticosteroids. Characteristics, classification, structure-activity relationship, mechanism of action, metabolism, methods of production, methods of analysis, application in medicine.
65. Androgens, anabolic steroids and their analogs. Characteristics, classification, structure-activity relationship, mechanism of action, metabolism, methods of production, methods of analysis, application in medicine.
66. Gestagens, estrogens. Birth control. Estrogens of non-steroidal structure. Characteristics, classification, structure-activity relationship, mechanism of action, metabolism, methods of production, methods of analysis, application in medicine.
67. Water-soluble vitamins. Characterization, classification, structure-activity relationship, mechanism of action, metabolism, methods of production, methods of analysis, application in medicine.
68. Fat-soluble vitamins. Characterization, classification, structure-activity relationship, mechanism of action, metabolism, methods of production, methods of analysis, application in medicine.
69. Sorbents, antidotes and complexes. Characteristics, classification, structure-activity relationship, mechanism of action, metabolism, methods of production, methods of analysis, application in medicine.
70. Antiulcer drugs. Drugs for the treatment of alcoholism. Characteristics, classification, structure-activity relationship, mechanism of action, metabolism, methods of production, methods of analysis, application in medicine.
71. X-ray contrast and other diagnostic tools. Characteristics, classification, mechanism of action, methods of production, methods of analysis, application in medicine.

The topics of the lecture course reveal the problematic issues of the relevant sections of the discipline. Practical classes provide a theoretical justification of the main issues of the topic and the acquisition of the following practical skills:

- 1) getting to know the main methods of obtaining medicinal substances and methods of their analysis;
- 2) organization of the workplace;
- 3) sampling for analysis;
- 4) analysis of the quality of drugs using physical, physical and chemical, and chemical methods;
- 5) implementation of the necessary calculations to assess the quantitative content of medicines;
- 6) formulation of conclusions regarding the quality of drugs in accordance with the requirements of regulatory documents and quality control methods.

The student's independent work provides preparation for practical classes and intermediate tests, study of topics for independent extracurricular work, writing essays, preparation of presentations, tables. The control of mastering the topics of independent extracurricular work is carried out at the intermediate control classes and the final control of the discipline.

Individual work includes the study of scientific literature, preparation of reviews on the topics provided for presentation at the meetings of the student scientific circle, the implementation of scientific and practical researches, participation in specialized competitions, scientific and practical conferences and organization of students' research works.

Thematic plans of lectures, calendar plans of practical classes, thematic plan of independent extracurricular work, volume and directions of individual work are published on the website of the department.

The route for obtaining materials: Department of Pharmaceutical Chemistry / for students / Full-time education / (specialty 226 Pharmacy, Industrial Pharmacy) / 3rd (4th, 5th) course / Educational materials / or through the link <https://www.vnmu.edu.ua/en/> department of Pharmaceutical Chemistry #. Access to the materials is carried out through the student's corporate account s000XXX@vnmu.edu.ua.

5. Forms and methods of monitoring academic performance

Current control in practical studies	Methods: <i>oral or written survey, testing, electronic survey, solving situational problems, conducting laboratory studies, interpreting them and evaluating their results (drawing up a protocol in a workbook)</i>
Final control of the discipline - <i>differentiated credit</i>	Methods: <i>pre-examination testing, oral questioning</i> (according to the Regulation of the Academic process in National Pirogov Memorial Medical University, Vinnytsya (link https://www.vnmu.edu.ua/en/general-regulations)
Learning success diagnostic tools	Theoretical questions, tests, practically-oriented situational tasks, practical tasks, practical skills demonstration

6. Assessment criteria

Knowledge assessment is carried out in accordance with the Regulations of the Academic process in National Pirogov Memorial Medical University, Vinnytsya (link <https://www.vnmu.edu.ua/en/general-regulations>)

Continuous assessment	On a five point system of traditional assessments: 5 «excellent», 4 «good», 3 «satisfactory», 2 «unsatisfactory»
Midpoint separation assessment	On a five-point system of traditional assessments
Control of practical skills	According to the five-point system of traditional assessments
Final control of the discipline	<i>Sum of points for pre-examination testing (12-20 points) and oral questioning (38-60 points) (for disciplines included in Step 1,2)</i> Exam grade: 71-80 points - "excellent" 61-70 points - "good" 50-60 points - "satisfactory" Less than 50 points - "unsatisfactory" / did not pass
Discipline assessments:	Current academic assessment - from 72 to 120 points (conversion of the average traditional assessment of

	practical class on a 120-point scale): 60% of the grade for the discipline Final control - from 50 to 80 points: 40% of the grade for the discipline Individual work - from 6 to 12 points From 122 to 200 points in total.
--	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Discipline Score Scale: National and ECTS

The sum of grades for all types of educational activities	Score ECTS	Score on a national scale	
		For exam, course project (work), practice	for credit test
180-200	A	excellent	credited
170-179,99	B	good	
160-169,99	C		
141-159,99	D	satisfactory	
122-140,99	E	satisfactory	
0-121,99	FX	unsatisfactory with the possibility of reassembly	is not credited with the possibility of reassembling
	F	unsatisfactory with a mandatory reexamination of discipline	is not credited with mandatory reexamination of discipline

7. Policy of discipline / course

The student has the right to receive high-quality educational services, access to contemporary scientific and educational information, qualified advisory assistance during the study of discipline and mastering practical skills. The policy of the department during the providing of educational services is a student-centered, based on normative documents of the Ministry of Education and the Ministry of Health of Ukraine, the Statute of the University and the Procedure for the Providing of Educational Services regulated by the main principles of the organization of the educational process in National Pirogov Memorial Medical University, Vinnytsya and the principles of academic integrity (link <https://www.vnmu.edu.ua/en/general-regulations>).

Adherence to the rules of VNMU, safety techniques during practical classes.

Requirements for preparation for practical classes. Student should be present at the practical lesson on time, theoretically prepared according to the topic, adhere to the necessary for work in the laboratory form of clothing (medical gown, if necessary - hat, gloves, etc.). When performing a laboratory work, it is necessary to strictly follow the rules and safety precautions, experiments are possible only in the presence of a teacher or laboratory assistant in the classroom. Show tolerance, courtesy, tact and respect to other participants during the discussion.

Usage of mobile phones and other electronic devices. The use of electronic devices is allowed, but limited to individual cases. It is allowed to use these devices for testing on the Microsoft Teams platform, for mathematical calculations ("Calculator" function), for processing literary sources in electronic form (agreement with teacher is required). It is forbidden to use electronic devices during classes for photo, audio and video recording without the consent of all participants of the educational process, for entertainment purposes, as well as during an oral survey.

Academic integrity. When studying the discipline, the student must be guided by the Code of Academic Integrity and Corporate Ethics of National Pirogov Memorial Medical University, Vinnytsya (link: <https://www.vnmdu.edu.ua/en/general-regulations/> Code of Academic Integrity). In case of violation of the norms of academic integrity during the current and final controls student receives a grade of "2" and must work it out to his teacher in the prescribed manner within two weeks after receiving an unsatisfactory assessment).

Missed classes. Missed classes are working out in the manner prescribed by Regulations of the Academic process in National Pirogov Memorial Medical University, Vinnytsya (link <https://www.vnmdu.edu.ua/en/general-regulations/>) at the time of work out schedule (published on the website of the department <https://www.vnmdu.edu.ua/> department of Pharmaceutical Chemistry #) to the teacher on duty. To work out missed lesson student must provide permission from the dean's office, pass multiple choice questions (MCQ) on a missed topic and recitation, work out laboratory work (if the latter is in a particular topic), draw up a laboratory report and defend it to the teacher on duty.

Note. To ensure the completion of the laboratory works, it is necessary to apply in advance to the laboratory assistant of pharmaceutical chemistry department and indicate the topic and specific date of rework to prepare the necessary reagents, laboratory utensils, etc.

The reworks of missed lectures are carried out to the lecturer of the subject, with the permission of the dean, the abstract of the lecture, a short recitation on the topic of the lecture is possible.

The procedure for admission to the discipline final control is given in the Regulations of the Academic process in National Pirogov Memorial Medical University, Vinnytsya (link <https://www.vnmdu.edu.ua/en/general-regulations/>). To the final control allowed students who do not have missed practical classes and lectures and received an average traditional grade of at least "3".

Additional points. Individual points in the discipline (from 6 to 12) that student can receive for individual work, the amount of which is published on the website of the department in the educational methodical materials of the discipline, the number of points is determined by the results of IRS according to Regulation of the Academic process in National Pirogov Memorial Medical University, Vinnytsya (link <https://www.vnmdu.edu.ua/en/general-regulations/>).

Conflict resolution. In case of misunderstandings and complaints to the teacher because of the quality of educational services, knowledge assessment and other conflict situations, student should submit his / her claims to the teacher. If the issue is not resolved, the student has the right to apply to the head of the department according to Complaints Consideration Procedure in VNMU named after M.I. Pirogov (link <https://www.vnmua.edu.ua/en/general-regulations>)

Politics in terms of remote learning. Distance learning regulated by the Regulations of the elements of remote learning in National Pirogov Memorial Medical University, Vinnytsya (<https://www.vnmua.edu.ua/> General information). The main training platforms for studying are Microsoft Team and Google Meets. Practical classes and lectures, exercises and consultations during distance learning is published on the website of the department ([https://www.vnmua.edu.ua/en/ Department of Pharmaceutical Chemistry / to Students](https://www.vnmua.edu.ua/en/Department of Pharmaceutical Chemistry / to Students) or <https://www.vnmua.edu.ua/en/Department of Pharmaceutical Chemistry / News>).

Feedback from teachers is via messengers (Viber, Telegram, WhatsApp) or e-mail (at the teacher's choice) during working hours.

1. **Educational resources.**


Educational and methodological support of the discipline is published on the website of the department ([https://www.vnmua.edu.ua/ en/ department of Pharmaceutical Chemistry / for students](https://www.vnmua.edu.ua/en/department of Pharmaceutical Chemistry / for students)). Consultations are held twice a week according to the schedule.

2. **The timetable and distribution of groups** with assigned teachers are published on the web page of the department (([https://www.vnmua.edu.ua /en/ department of Pharmaceutical Chemistry / for students](https://www.vnmua.edu.ua/en/department of Pharmaceutical Chemistry / for students)).

3. Questions to the intermediate and final semester control (credit) of the discipline are published on the web page of the department ([https://www.vnmua.edu.ua / en/ department of Pharmaceutical Chemistry / for students](https://www.vnmua.edu.ua/en/department of Pharmaceutical Chemistry / for students)).

The syllabus of the discipline " Standardization of medicines " was discussed and approved at the meeting of the department of Pharmaceutical Chemistry (record № 1, dated "01" September 2022)

Responsible for the academic

discipline 

Associate professor of HEI Shepeta Y.L.

Head of the department 

Associate professor of HEI Yuschenko T.I.