MINISTRY OF HEALTH OF UKRAINE
ODESA NATIONAL MEDICAL UNIVERSITY
Department of Pharmaceutical Chemistry and Drug Technology

Syllabus of the educational discipline
"Analytical chemistry"

Scope of the educational discipline	Total hours per discipline: 240 hours, 8 credits. Semesters: III-IV. 2nd year.
Days, time, place of the academic discipline	According to the schedule of classes. Department of Pharmaceutical Chemistry. Odesa, st. Marshal Malinovskyi, 37.
Teacher (-s)	Senior Lecturer Nikitin Oleksii. Assistants: Lytvynchuk Iryna, Ulizko Igor, PhD Holubchyk Khrystyna.
Contact Information	Help by phones: Nikitin Oleksii, head teacher of the department 067-485-11-06 Klyvniak Iryna, senior laboratory assistant 0487779828 E-mail: pharmchemistry@onmedu.edu.ua Face-to-face consultations: from 2:00 p.m. to 5:00 p.m. every Thursday, from 9:00 a.m. to 2:00 p.m. every Saturday. Online consultations: from 4:00 p.m. to 6:00 p.m. every Thursday, from 9:00 a.m. to 2:00 p.m. every Saturday. The link to the online consultation is given to each group during the classes separately.

COMMUNICATION

Communication with applicants will be conducted in the classroom (face-to-face).

During distance learning, communication is carried out through the Microsoft Teams platform, as well as through e-mail correspondence, Viber messengers (through groups created in Viber for each group, separately through the head of the group), Telegram.

ABSTRACT OF THE EDUCATIONAL DISCIPLINE

Subject of discipline study – the relationship between the analytical properties of elements and their compounds and the position in the periodic table of D.I. Mendeleev, as well as the principles of qualitative and quantitative analysis of inorganic and organic substances.

Prerequisites: is based on students' study of inorganic chemistry, biophysics, medical biology and integrates with these disciplines.

Postrequisites: assimilation of knowledge in analytical chemistry and its application for further study of the cycle of pharmaceutical disciplines, and will also be widely used in the practical work of a specialist.

Goal – is formation of systematic knowledge on the theory of qualitative and quantitative chemical analysis and acquisition of skills and practical skills for their implementation.

Tasks of the discipline: to form students' knowledge of the theoretical foundations of qualitative and quantitative methods of analysis; ensure that students master the technique of performing basic analytical operations; teach students to work with the main types of equipment used in chemical and pharmaceutical analysis; to teach students to apply the acquired knowledge to the analysis of medicines and chemicals; to learn how to evaluate the results of an analytical experiment using mathematical processing; to form chemical-analytical thinking in order to use the most rational method of analysis to solve a specific analytical task, develop a research plan and perform an experiment; acquisition by students of practical competencies in the field of professional activity of pharmaceutical workers.

Expected results:

As a result of studying the educational discipline, the applicant must:

- *Know:* basic concepts and laws underlying analytical chemistry; the main stages of the development of analytical chemistry, its current state; the main provisions of the theory of ionic equilibria in relation to acid-base, redox, precipitation and complexiметric reactions; methods and methods of qualitative analysis; methods, techniques and methods of performing chemical and physico-chemical analysis to establish qualitative composition and quantitative determinations; methods of detecting cations and anions; methods of separation of substances (chemical, chromatographic, extraction); the basics of mathematical statistics regarding the assessment of the correctness and reproducibility of the results of quantitative analysis; safety rules when working in a chemical laboratory; the role and significance of analytical chemistry methods in pharmacy, in the practical activity of a pharmacist; main literary sources, reference literature on analytical chemistry.
- *Be able:* use measuring utensils, analytical scales; to possess the technique of performing basic analytical operations in the qualitative and quantitative analysis of substances, to prepare and standardize solutions of analytical reagents; select an average sample, draw up an analysis scheme, carry out qualitative and quantitative analysis of the substance within the limits of using the main techniques and methods provided by the program; work with the main types of devices used in analysis (microscopes, photoelectrocolorimeters, spectrophotometers, potentiometers, conductometers, polarimeters, etc.); choose the optimal method of qualitative and quantitative analysis of a substance; to construct titration curves and to establish on their basis the volumes of titrant used for each component of the mixture; separate cations and anions by chemical and chromatographic methods; conduct laboratory experiments, explain the essence of specific reactions and their analytical effects, draw up report documentation based on experimental data;

perform initial calculations, final calculations using statistical processing of the results of quantitative analysis; work independently with educational and reference literature on analytical chemistry.

- *to master skills:* the ability to think abstractly, analyze and synthesize, the ability to learn and be modernly trained; knowledge and understanding of the subject area and understanding of professional activity; ability to apply knowledge in practical situations; the ability to communicate in the state language; ability to adapt and act in a new situation; with determination and persistence in relation to assigned tasks and assumed responsibilities.

DESCRIPTION OF THE EDUCATIONAL DISCIPLINE

Forms and methods of education. The course will be taught in the form of lectures (30 hours) and practical classes (110 hours), organization of students' independent work (100 hours).

Teaching methods are used during practical classes: multimedia presentation is used in lectures; in practical classes - educational methodical materials, situational tasks, individual tasks, laboratory equipment, to test acquired knowledge and skills - test and calculation tasks, for independent work a list of necessary literary sources is provided.

Content of the education discipline

Topic 1. Introduction to qualitative analysis.
Topic 2. Qualitative reactions for the determination of cations of analytical group I.
Topic 3. Theory of strong electrolytes.
Topic 4. Heterogeneous equilibria.
Topic 5. Qualitative reactions for the determination of cations of II and III analytical groups.
Topic 6. Systematic course of analysis of a mixture of cations of I-III analytical groups according to acid-base classification.
Topic 7. Acid-base equilibria in analytical chemistry.
Topic 8. Qualitative reactions for the determination of cations of the IV analytical group.
Topic 9. Equilibria in complexation reactions.
Topic 10. Qualitative reactions for the determination of cations of V and VI analytical groups.
Topic 11. Systematic course of analysis of a mixture of cations of IV-VI analytical groups according to acid-base classification.
Topic 12. Systematic course of analysis of a mixture of cations of I-VI analytical groups according to acid-base classification.
Topic 13. Redox equilibria in analytical chemistry.
Topic 14. General characteristics of anions and analytical classification of anions by groups. Qualitative reactions for the determination of anions of analytical group I and the conditions for their performance.

Topic 15. Qualitative reactions for the determination of anions of II and III analytical groups and the conditions for their performance.
Topic 16. Analysis of a mixture of anions of groups I-III.
Topic 17. Methods of separation and concentration of substances in analytical chemistry.
Topic 18. Introduction to quantitative analysis. Weighing technique.
Topic 19. Gravimetric analysis. Application of gravimetry for the analysis of medicinal substances.
Topic 20. Titrimetric methods of analysis. Calculations in titrimetric analysis.
Topic 21. Acid-base titration. Titration of strong acids with strong bases and vice versa.
Topic 22. Acid-base titration. Titration of weak acids with alkalis and weak bases with strong acids.
Topic 23. Acid-base titration. Titration of polybasic acids, polyacid bases, mixtures of acids or bases.
Topic 24. Acid-base titration. Titration of ampholytes. Statistical processing of analysis results.
Topic 25. General provisions of redox titration.
Topic 26. Redox titration. Permanganatometry.
Topic 27. Redox titration. Iodimetry, iodometry.
Topic 28. Redox titration. Dichromatometry.
Topic 29. Redox titration. Bromatometry.
Topic 30. Redox titration. Nitritometry.
Topic 31. General provisions of precipitation titration.
Topic 32. Precipitation titration. Argentometry. Mercurometry.
Topic 33. Complex symmetric titration. Complexonometry.
Topic 34. Optical methods of analysis. Photocolorimetry and spectrophotometry. Electrochemical methods of analysis.

Recommended literature list:

Basic:

1. Analytical chemistry: handbook / V. V. Bolotov, O. A. Yevtifeyeva, L. Yu. Klimenko, T. A. Kostina, T. V. Zhukova, E. Yu. Ahmedov , O. A. Brizicky; edited by V. V. Bolotov.— Kharkiv: NUPh; Original, 2012.
2. Analytical chemistry (Qualitative analysis). Part I / O. A. Ievtifieieva, V. V. Bolotov, T. A. Kostina, O. M. Svechnikova, T. I. Yuschenko, N. I. Kaminska, A. E. Kosareva, L. V. Slobodyanyuk, O. P. Yashchuk ; edited by O. A. Ievtifieieva. – Kharkiv : Publishing house the CLL «Generous farmstead plus», 2014. – 168 p.
3. Analytical chemistry. Part II. Quantitative analysis: the manual for foreign students of pharmaceutical higher schools and pharmaceutical departments of medical higher schools of the III – IV accreditation levels / V. V. Bolotov, O. M. Svechnikova, T. A. Kostina et al. – Kharkiv: NUPh, 2010. – 160 p.

4. Analytical chemistry: textbook [the textbook for students of higher schools] / I.S. Grytsenko, V. V. Bolotov, L.Yu. Klimenko et al.; ed. by I.S. Grytsenko – Kharkiv: NUPh, Golden Pages, 2019. – 600 p.

EVALUATING

Forms and methods of current control: oral survey, testing, evaluation of practical skills, problem solving.

Current evaluation criteria in practical training

Evaluation	Evaluation criteria
"5"	The applicant takes an active part 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 issued 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.

Forms and methods of final control: the applicant is admitted to the exam on the condition that the requirements of the educational program are met and if he received at least 3.00 points for the current educational activity and passed the test control of the "STEP-1" tests with at least 90% (50 tasks).

The test control is held in the Educational and Production Complex of Innovative Technologies of Learning, Informatization and Continuous Education of ONMedU in the last session on the eve of the exam.

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Possibility and conditions of obtaining additional (bonus) points: not provided.

INDEPENDENT WORK OF HIGHER EDUCATION ACQUIRES

Independent work involves preparation for each practical session.

EDUCATIONAL DISCIPLINE POLICY

The policy on deadlines and rescheduling corresponds to the general rules at ONMedU. Absences of classes for non-respectable reasons will be worked out according to the schedule of the teacher on duty. Absences for valid reasons are worked out according to an individual schedule with the permission of the dean's office.

*Observance of academic integrity by applicants is mandatory, namely: I*ndependent performance of all types of work, tasks, forms of control provided for by the work program of this educational discipline; references to sources of information in the case of using ideas, developments, statements, information; compliance with the legislation on copyright and related rights; provision of reliable information about the results of one's own educational (scientific) activity, used research methods and sources of information.

Attendance and Tardiness Policy:
Uniform: a medical gown that completely covers the outer clothing.
Equipment: notebook, pen.
State of health: applicants suffering from acute infectious diseases, including respiratory diseases, are not allowed to attend classes.
A student who is late for a class can attend it, but if the teacher has put "nb" (absent) in the journal, he must complete it in the general order.

Use of mobile devices:
Mobile devices may be used by students with the permission of the instructor if they are needed for the assignment.

Behavior in the audience:
The behavior of applicants and teachers in the classrooms must be working and calm, strictly comply with the rules established by the Regulations on academic integrity and ethics of academic relations at Odessa National Medical University, in accordance with the Code of Academic Ethics and University Community Relations of Odessa National Medical University, Regulations on Prevention and detection of academic plagiarism in research and educational work of students of higher education, scientists and teachers of Odessa National Medical University.