**Odessa National Medical University**
**Faculty of Pharmacy**
**Department of Pharmaceutical Chemistry**

**Syllabus course**
**Organic chemistry**

| | |
|---|---|
| **Amount** | 8 credits 240 hours |
| **Semester, year of study** | 3, 4 semesters 2 years of study |
| **Days, time, place** | Days, time and place are determined according to the approved schedule |
| **Teachers** | Gelmboldt Vladimir Olegovich, Doctor of Chemical Sciences, Professor<br>Anisimov Vladimir Yurievich, Ph.D., Docent<br>Ulizko Igor Vitalievich, assistant<br>Shishkin Ivan Olegovich, assistant |
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| **Workplace** | Department of Pharmaceutical Chemistry |
| **Consultations** | Consultations take place according to the approved schedule, both offline (face-to-face) and offline online, using ICT available to students and teachers |

**COMMUNICATION with students**: E-mail, social networks, face-to-face meetings.

**COURSE ANNOTATION**

*Subject of study of the discipline:*
general theoretical provisions of organic chemistry with the subsequent description of reactivity of the most important classes of organic substances.

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

*Postrequisites:*lays the foundations for students to study pharmaceutical chemistry, biological chemistry, general and molecular pharmacology and toxicology.

*Course purpose:* The purpose of teaching organic chemistry is the formation of system knowledge with general theoretical provisions of organic chemistry with a subsequent description of the reactivity of the most important classes of organic substances. Study of the composition, structure, nomenclature and properties of organic substances in their relationship, conditions and ways of transformation of some substances into others.

*Tasks of the discipline:*

mastering the basic laws and regulations of chemistry; theories of atomic structure, chemical bonding and structure of organic molecules; establishing the relationship between the structure, reactivity and properties of organic compounds to the extent necessary to further study and understand the basic chemical and biological processes that occur at the molecular level and their impact on human nature and the environment.

*Expected results:*

- general provisions and rules of organic chemistry
- electronic structure of organic compounds;
- types of chemical reactions;
- main classes of organic compounds and their properties;
- nomenclature of organic compounds;
- qualitative analysis of organic substances by functional groups.
- know the names and purposes of chemical utensils and laboratory equipment.
- be able to make separate laboratory installations.
- have methods of purification of liquid and crystalline organic compounds and be able to confirm their purity.
- be able to determine the physical constants of organic compounds (melting point, boiling point, specific rotation).
- independently conduct elemental analysis of organic compounds (discovery of carbon, hydrogen, sulfur, nitrogen, halogens).
- to know laboratory methods of extraction of separate organic compounds.
- know the qualitative reactions to the multiple bond and the main functional groups (halogen, amino group, alcohol and phenolic hydroxyl, aldehyde, ketone and carboxyl groups).
- have separate physico-chemical methods for the identification of organic compounds.
- be able to use chemical and reference literature, work with tabular and graphic material.

**COURSE DESCRIPTION**

*Forms and methods of teaching*

The course will be presented in the form of lectures (30 hours) and practical classes (120 hours), organization of independent work of students (90 hours)

The lectures use a multimedia presentation; in practical classes - teaching materials, situational tasks, individual tasks, laboratory equipment, to test the acquired knowledge and skills - test and calculation tasks, for independent work provided a list of necessary literature sources.

*The content of the discipline*

Topic 1.The subject of organic chemistry. Classification and nomenclature of organic compounds. Types of chemical bonds and mutual influence of atoms in organic molecules.

Topic 2.Isomerism of organic compounds. Acid and basic properties of organic compounds.

Topic 3. Classification of organic reactions and reagents. Methods for establishing the structure of organic compounds.
Topic 4. Classification, nomenclature, isomerism of organic compounds. Types of chemical bonds and mutual influence of atoms in organic compounds. Electronic effects of substituents.
Topic 5. Alkanes.
Topic 6. Cycloalkanes.
Topic 7. Alkenes. Alkadienes.
Topic 8. Alkynes.
Topic 9. Mononuclear arenas.
Topic 10. Multinuclear arenas. Non-benzoid aromatic compounds.
Topic 11. Hydrocarbons.
Topic 12. Halogenated hydrocarbons. Haloalkanes. Halogenalkenes.
Topic 13. Halogenarenes and arylalkyl halides.
Topic 14. Nitro compounds.
Topic 15. Aliphatic amines.
Topic 16. Aromatic amines. Diamines. Identification of amines.
Topic 17. Diazo-, azo compounds.
Topic 18. Alcohols. Phenols.
Topic 19. Ethers. Thioalcohols and thioethers.
Topic 20. Halogen- and nitrogen-containing derivatives of hydrocarbons. Hydroxy derivatives of hydrocarbons.
Topic 21. Aldehydes and ketones.
Topic 22. Monocarboxylic acids.
Topic 23. Dicarboxylic acids.
Topic 24. Functional derivatives of carboxylic acids.
Topic 25. Halocarboxylic, hydroxy- and phenolic acids.
Topic 26. Oxo- and amino acids.
Topic 27. Sulfonic acids. Carbonic acid and its functional derivatives.
Topic 28. Ox compounds. Carboxylic acids and their functional and heterofunctional derivatives.Sulfonic acids. Carbonic acid and its functional derivatives.
Topic 30. Five-membered heterocyclic compounds with one heteroatom. Five-membered heterocycles with two heteroatoms.
Topic 31. Six-membered heterocycles with one heteroatom.
Topic 32. Azines with condensed cycles: quinoline, isoquinoline, acridine. Heterocycles of the piranha group.
Topic 33. Six-membered heterocycles with two heteroatoms.
Topic 34. Seven-membered heterocycles. Condensed heterocycle systems.
Topic 35. Heterocyclic compounds.
Topic 36. General characteristics of carbohydrates. Monosaccharides.
Topic 37. Di- and polysaccharides.
Topic 38. Proteins.
Topic 39. Lipids. Jury.
Topic 40. Carbohydrates. Proteins. Lipids. Jury.

*List of recommended literature:*

1. Chernykh V.P., Shemchuk L.A. Organic Chemistry. – Kharkiv: Original, 2011. – 440 p.
2. Jie Jack Li, Chris Limberakis, Derek A. Pflum Modern Organic Sinthesis. – Oxford.: University Press, 2007.
3 Загальний практикум з органічної хімії / В.П. Черних, І.С. Гриценко, М.О. Лозинський, З.І. Коваленко; За ред. В.П. Черних. – Х.: Вид-во НфаУ; Золоті сторінки, 2003. – 592 с.
4. 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.
5. 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.
6. 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.
7 Биологическая и биоорганическая химия: учеб. пособие для студ. вузов / А.А. Мардашко, Л.М. Миронович, Г.Ф. Степанов. – К. : Каравелла, 2008. – 248 с.
8. Черных В.П. Лекции по органической химии – Х.: НФаУ; Золотые страницы, 2005. – 480 с.

**EVALUATION**

During the study of the discipline various forms of lesson control are used (oral, written, combined, testing, practical skills, etc.). The results of students' academic performance are presented in the form of assessment on the national scale, 200-point and ECTS scale and have standardized generalized criteria for assessing knowledge.

Assessment of knowledge is on a national scale:

- a grade "excellent" is given to a student who systematically worked during the term, showed during the test versatile and deep knowledge of the program material, is able to successfully perform the tasks provided by the program, mastered the content of basic and additional literature, realized the relationship of individual sections of the discipline importance for the future profession, showed creative abilities in understanding and using educational material, showed the ability to independently update and replenish knowledge; level of competence - high (creative);
- a grade "good" is given to a student who has shown full knowledge of the curriculum, successfully completes the tasks provided by the program, mastered the basic literature recommended by the program, showed a sufficient level of knowledge in the discipline and is able to independently update and update during further study and professional activity; level of competence - sufficient (constructive-variable);

- a grade "satisfactory" is given to the student who has shown knowledge of the basic educational program material in the volume necessary for the further training and the subsequent work on a profession, copes with performance of the tasks provided by the program, has made separate mistakes in answers on examination and at performance of examination tasks, but has the necessary knowledge to overcome mistakes under the guidance of a researcher; level of competence - average (reproductive);
- a grade "unsatisfactory" is given to the student who did not show sufficient knowledge of the basic educational and program material, made fundamental mistakes in performance of the tasks provided by the program, cannot use the knowledge at the further training without the help of the lecturer/tutor, failed to master skills of independent work; the level of competence is low (receptive-productive).

**The order of assessment of student's educational activity**

*Methods of current control:*current controlcarried out at each practical lesson in accordance with the specific objectives of the topic. All practical classes use objective control over the performance of independent work, theoretical training and acquisition of practical skills. The following means of diagnosing the level of preparation of students are used: oral examination, testing, solving situational problems.

*A form of final control* knowledge of the discipline is an exam. The grade for the discipline is 50% of the current performance (arithmetic mean of all current student grades) and 50% - the grade on the exam.

To evaluate the discipline on a 4-point traditional (national) scale, the average score for the discipline is first calculated as the arithmetic mean of the two components:

1. the average current score as the arithmetic of all current scores (calculated as a number rounded to 2 (two) decimal places.
2. traditional exam grade.

Tickets for the exam consist of theoretical (2 questions) and practical questions (2 questions) in all sections studied in this discipline. Tasks include all the main sections of the course, designed for written completion within 90 minutes. Designed to test knowledge, skills and abilities in solving specific problems. Examples of examination questions are given in the appendix to the work program

**Conversion of a traditional grade from a discipline on a multi-point scale.**

The multi-point scale characterizes the actual success of each student in mastering the discipline. Conversion of the traditional grade from the discipline to 200-point is performed by the information and computer center of the university program "Contingent" according to the formula:

**Average score of success (current / discipline) x 40**

| national assessment | marks |
|---|---|
| «5» | 185-200 |
| «4» | 151-184 |
| «3» | 120-150 |

The ECTS rating scale evaluates the achievements of students in the discipline who study in one course of one specialty, in accordance with the points obtained by them, by ranking, namely:

| Scale ECTS | Statistical index |
|---|---|
| «A» | The best 10 % of students |
| «B» | Next 25 % of students |
| «C» | Next 30 %of students |
| «D» | Next 25 % of students |
| «E» | The last 10% of students |

The ECTS scale establishes the student's belonging to the group of the best or worst among the reference group of classmates (faculty, specialty), ie his rating. When converting from a multi-point scale, as a rule, the limits of grades "A", "B", "C", "D", "E" do not coincide with the limits of grades "5", "4", "3" on the traditional scale. A grade of "A" on the ECTS scale cannot be equal to a grade of "excellent", and a grade of "B" - a grade of "good" and so on.

Students who have received grades "Fx" and "F" ("2") are not included in the list of ranked students. Such students automatically receive a score of "E" after re-assembly.

The grade "Fx" is given to students who have scored the minimum number of points for the current educational activity, but who do not pass the final control.

Grade "F" is given to students who have attended all classes in the discipline, but did not score an average score (3.00) for current academic activities and are not admitted to the final control.

**COURSE POLICY**

*Deadline and recompilation policy*

Students who have completed all types of work provided for in the initial program, completed all training sessions and scored at least the minimum number of points while studying the module are admitted to the final control.

Rehearsals of missed practical classes, regardless of the reason for admission, and consultations take place in accordance with the departmental schedule of rehearsals and consultations. The practice of missed practical classes is carried out with an entry in the journal of the department's work and a mark on the permit form from the dean's office. Skipping a lecture without a good reason is completed by the student through an interview with the lecturer, or a presentation of the missed topic. Rearrangement of the current and final modules in order to increase the assessment is not allowed, except for situations provided by the "Regulations on the diploma of the state standard with honors"

*Academic Integrity Policy*

Adherence to academic integrity by students provides:

- independent performance of educational tasks, tasks of current and final control of learning outcomes (for persons with special educational needs this requirement is applied taking into account their individual needs and opportunities);
- links to sources of information in the case of the use of ideas, developments, statements, information;
- compliance with the legislation on copyright and related rights;
- providing reliable information about the results of their own (scientific, creative) activities, used research methods and sources of information.

Unacceptable in educational activities for participants in the educational process are:

- the use of family or business ties to obtain a positive or higher assessment in the implementation of any form of control over learning outcomes or advantages in scientific work;
- use of prohibited auxiliary materials or technical means (cheat sheets, abstracts, headphones, telephones, smartphones, tablets, etc.) during control measures;
- passing procedures of control of results of training by fictitious persons.

For violation of academic integrity, students may be held subject to the following academic liability:

- reduction of results of assessment of control work, examination, credit, etc .;
- re-assessment (test, exam, test, etc.);
- appointment of additional control measures (additional individual tasks, control works, tests, etc.);
- re-passing the relevant educational component of the educational program;
- conducting additional verification of other works by the infringer;
- deprivation of the right to participate in competitions for scholarships, grants, etc .;
- notification of the entity that finances the training (research), the institution that issued the grant for training (research), potential employers, parents of the applicant for higher education about the violation;
- exclusion from the rating of applicants for an academic scholarship or accrual of penalty points in such a rating;
- deprivation of an academic scholarship;
- deprivation of tuition benefits provided by the University;
- deductions from the University.

*Attendance and lateness policy:* Attendance at all classes: lectures, practical classes, current and final control is mandatory (exception: good reason). Delay of more than 5 minutes without good reason is not allowed. Within two days, in any form convenient for the student, inform the dean's office about the reasons that make it impossible to attend classes and perform other tasks provided by the curriculum.

*Mobile devices:* it is forbidden to write off during the control of knowledge (including the use of mobile technical means of information transfer).

*Audience behavior:*

- attend lectures, laboratory classes according to the schedule in bathrobes;
- do not be late for class;
- do not talk during classes;

- turn off your mobile phone,