

**National Pirogov Memorial Medical University, Vinnytsia**

**“APPROVED ”**

Vice - Rector for Academic Affairs

\_\_\_\_\_ Prof. Y.I. Guminskiy

“31” August 2021 year

**“ AGREED ”**

Head of the Department Biological and  
General Chemistry

\_\_\_\_\_ Prof. N.V. Zaichko

“27” August 2021 year

**SYLLABUS  
of academic discipline  
«MEDICAL CHEMISTRY»**

Specialty	228 Medicine
Educational level	Master
Educational programme	EPP «Pediatrics», 2020
Academic year	2021-2022
Department	Biological and General Chemistry
Lecturer (if lectures are given)	Senior Lecturer Shunkov V.S.
Contact information	<i>biochem@vnm.u.edu.ua, Pyrohova St, 56, (morphological corpus), (0432) 570271</i>
Syllabus compiler	Senior Lecturer Shunkov V.S.

## 1. Status and structure of the discipline

Discipline status	Required
Discipline code in EPP/ discipline place in EPP	EC 12 / discipline of natural science (fundamental) training
Course / semester	1 course (I semester)
The amount of discipline ( the total number of hours / number of credits ECTS)	120 hours /4 credits ECTS
Number of content modules	4
The structure of the discipline	Lectures - 18 hours Practical classes - 50 hours Independent work - 52 hours
Language of study	English
Form of study	Full - time (at introduction of quarantine measures - remote full - time)

## 2. Description of the discipline

**Short annotation of the course, relevance.** The program of the discipline “«Medical Chemistry» is compiled in accordance with the procedure for training applicants for the second (master’s) level of education in higher medical educational institutions of Ukraine in accordance with the requirements of the credit transfer system of the ECTS educational process.

The main focus of the program is to gain knowledge of the fundamental compulsory discipline «Medical Chemistry», the study of which is necessary for the successful mastering of a number of clinical disciplines. The subject area of the program is to provide medical students with the knowledge necessary to understand the functions of individual body systems, the body’s interaction with the environment, as well as the ability to use a variety of quantitative calculations to analyze certain processes.

**Prerequisites.** The teaching of medical chemistry is carried out without prior study in medical universities of the course of general chemistry, so the study of the material of medical chemistry is based on the knowledge that students received in school.

**The purpose of the course and its significance for professional activities.** During the study of the discipline students acquire theoretical knowledge and practical skills that are needed during the study of disciplines that explain the processes of life in theoretical and clinical departments.

**Postrequisites.** Knowledge, skills and abilities acquired after the study of medical chemistry are the basis for further study of biochemistry, pharmacology, normal and pathological physiology, biophysics, hygiene and ecology, some clinical disciplines.

## 3. Learning outcomes.

After successful study of the discipline the applicant will be able to:

*to know:* interrelation and influence of the physical and chemical phenomena on processes in a human body;

*be able to:* use theoretical knowledge to perform practical tasks related to the analysis of processes in vitro and in vivo;

*able to demonstrate:* knowledge and practical skills in the discipline;

*have the skills:* work in a chemical laboratory during the analysis of drugs and biological fluids;

*decide independently:* to analyze information, make informed decisions, be able to obtain modern knowledge.

## 4. Content and logistics of the discipline

<b>Medical chemistry</b> Module 1. Content modules – 4	1 semester 120 hours / 4 credits	Lectures № 1-9 Practical classes №№ 1-25 Topics for self- study №№ 1-14
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The discipline includes 17 topics (studied in 24 practical classes), which are combined into one module (structured into four content modules), and ends with a differentiated test, which is conducted in practical lesson №25.

### **Content module 1. Chemistry of nutrients. Complex formation**

Topic 1 (practical lesson № 1). Introduction. Safety precautions. Periodic system D.I. Mendeleev. Electronic structure of atoms of elements and their ions. Test control to determine the initial level of knowledge.

Topic 2 (practical lesson № 2). Biogenic s-elements: chemical properties, biological role, application in medicine.

Topic 3 (practical lesson № 3). Biogenic p-elements: chemical properties, biological role, application in medicine.

Topic 4 (practical lesson № 4). Biogenic d-elements: chemical properties, biological role, application in medicine.

Topic 5 (practical lesson № 5). Complex formation in biological systems.

### **Content module 2. Acid-base equilibria in biological fluids**

Topic 6 (practical lesson № 6). Methods of expressing the concentration of solutions. Preparation of solutions.

Topic 7 (practical classes № 7-8). Acid-base balance in the body. Hydrogen pH of biological fluids.

Topic 8 (practical classes № 9-10). Neutralization method. Alkalimetry. Acidimetry.

Topic 9 (practical classes № 11-12). Buffer systems, classification and mechanism of action. Buffer capacity. The role of buffer solutions in biosystems.

Topic 10 (practical lesson № 13). Colligative properties of solutions. Osmosis.

### **Content module 3. Thermodynamics of solutions and electrode processes**

Topic 11 (practical lesson № 14). Thermal effects of chemical reactions, direction of processes

Topic 12 (practical classes № 15-16). Kinetics of biochemical reactions. Chemical equilibrium. The product of solubility.

Topic 13 (practical classes № 17-18). Potentiometric method of analysis. Determination of redox potential.

### **Content module 4. Surface phenomena at the phase boundary**

Topic 14 (practical lesson № 19). Sorption of biologically active substances at the liquid-gas interface.

Topic 15 (practical classes № 20-21). Sorption of biologically active substances at the interface solid-solution. Ion exchange. Chromatography.

Topic 16 (practical classes № 22-23). Obtaining, purification, properties of colloidal solutions. Coagulation of colloidal solutions. Colloidal protection.

Topic 17 (practical lesson № 24). Properties of biopolymer solutions. Isoelectric point of protein. Computer testing.

### **Practical lesson №25. Differentiated credit**

The topics of the lecture course reveal the problematic issues of the relevant sections of medical chemistry.

Practical classes provide a theoretical justification of the main issues of the topic and the acquisition of the following practical skills:

1) Compilation of formulas for the main classes of inorganic compounds (be able to give them a name), complex compounds (be able to give them a name, determine the charge of the complexing agent, complex ion), micelles of colloidal solutions (determine the charge of the granules)

- 2) Compilation of equations of acid-base reactions, redox reactions (arrange the coefficients by electronic balance, determine oxidants and reducing agents, oxidation and reduction processes)
- 3) Knowledge of qualitative reactions to basic inorganic cations and anions-
- 4) Knowledge of the basic principles of acid-base titration (be able to determine the equivalence point, titration jump, selection of indicators for titration), determination of surface tension of solutions by stalagmometric method, thin layer chromatography on paper and determination of  $R_f$
- 5) Solving computational problems:
  - Preparation of solutions of a certain concentration. Calculations of the amount of drug to be administered to the patient.
  - Calculation of pH of solutions of acids and bases, buffer systems.
  - Determination of buffer capacity by acid and alkali.
  - Calculation of osmotic pressure, depression of non-electrolyte and electrolyte solutions.
  - Calculations of the thermal effect of the reaction.
  - Calculation of the change in the free Gibbs energy of the reaction and prediction of the course of reactions.
  - Determination of the change in the reaction rate when changing the concentration of reagents, temperature.
  - Calculation of the reaction equilibrium constant, the product of the solubility of a sparingly soluble compound.
  - Calculations of EMF of galvanic cells and pH of solutions by potentiometric method.
  - Calculations of redox potential and ratio of components of redox systems.

In practical classes, students draw up protocols of research in workbooks, formulate conclusions on the topic and solve calculation problems and test tasks.

The student's independent work involves preparation for practical classes and development of practical skills, study of topics for independent extracurricular work, preparation of presentations, tables, processing of scientific literature and writing reviews of the provided topics for individual work. The control of mastering the topics of independent extracurricular work is carried out on the final control of the discipline.

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 site of the department.

Route for obtaining materials: Department of Biological and General Chemistry / Teaching materials / 1 course / Medicine / Medical Chemistry / Ukrainian / or by link <https://www.vnmu.edu.ua/> Department of Biological and General Chemistry #. Access to materials is provided from the student's corporate account [s000XXX@vnmu.edu.ua](mailto:s000XXX@vnmu.edu.ua).

## 5. Forms and methods of monitoring learning success

Current control in practical classes	Methods: oral or written survey, testing, electronic survey, solving computational problems, conducting laboratory work, their interpretation and evaluation of their results (registration of the protocol in the workbook)
Final control of the discipline - differentiated credit	Methods: test control, oral examination and solution of calculation problems (according to the regulations on the organization of the educational process in VNMU named after M.I. Pirogov) (link <a href="https://www.vnmu.edu.ua/">https://www.vnmu.edu.ua/</a> General information / Basic documents)
Tools for diagnosing learning success	Theoretical questions, tests, calculation problems, practical tasks, demonstration of practical skills

## 6. Evaluation criteria

Assessment of knowledge is carried out in accordance with the Regulations on the organization of the educational process VNMU named after M.I. Pirogov (link <https://www.vnmua.edu.ua/> General information / Basic documents)

Current control	According to the four-point system of traditional assessments: 5 «excellent», 4 «ood», 3 «satisfactory», 2 «unsatisfactory»
Control of practical skills	According to the four-point system of traditional evaluations
Final control of the discipline	Score for differential credit: 71-80 points - «excellent» 61-70 points - «good» 50-60 points - «satisfactory» Less than 50 points - «unsatisfactory» / did not pass
Discipline assessment:	Current performance - from 72 to 120 points (conversion of the average traditional grade for practical classes 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 1 to 12 points A total of 122 to 200 points.

Discipline assessment scale: national and ECTS

The sum of points for all types of educational activities	Rating ECTS	Score on a national scale	
		for exam, course project (work), practice	for credits
180-200	A	«excellent»	credited
170-179,9	B	«good»	
160-169,9	C		
141-159,9	D	«satisfactory»	
122-140,99	E	«satisfactory»	-
120-140,99	E	-	credited
119-61	FX	unsatisfactory with the possibility of reassembly	not credited with the possibility of re-assembly
1-60	F	unsatisfactory with compulsory re-study of the discipline	not credited with compulsory re-study of the discipline

## 7. Policy of discipline / course

The student has the right to receive quality educational services, access to modern scientific and educational information, qualified counseling during the study of the discipline and the acquisition of practical skills. The policy of the department during the provision of educational services is student-centered, based on regulations of the Ministry of Education and the Ministry of Health of Ukraine, the university charter and the procedure for providing educational services, regulated by the main provisions of the educational process at VNMU named after M.I. Pirogov and the principles of academic integrity.

**Observance of VNMU regulations, safety measures at practical classes.** Instruction on biosafety, safety of handling chemical reagents and burners is conducted at the first practical lesson by the

teacher. The briefing is recorded in the Safety Instruction Log. A student who has not been instructed is not allowed to perform practical work.

**Requirements for preparation for practical classes.** The student should be prepared for a practical lesson, test tasks for the current topic should be solved in a workbook, diagrams and tables are filled. You should come to class on time, without delay. A student who is more than 10 minutes late for class is not allowed to the last and must work it in the prescribed manner.

In practical classes, the student must be dressed in a work uniform (medical coat, hat). Students who do not have a work uniform are not allowed to study.

The student must follow the rules of safety in practical classes and during the stay in the department. When discussing theoretical issues, students should demonstrate tolerance, courtesy and respect for their colleagues and the teacher; when performing practical tasks, the workplace must be kept in order and be cleaned after the practical work.

**Use of mobile phones and other electronic devices.** The use of mobile phones and other electronic devices in class is not allowed.

**Academic integrity.** During the study of the discipline the student must be guided by the Code of Academic Integrity of Use of mobile phones and other electronic devices. The use of mobile phones and other electronic devices in class is not allowed.

Academic integrity. During the study of the discipline the student must be guided by the Code of Academic Integrity of VNMU named after M.I. Pirogov (<https://www.vnmue.edu.ua/> general information / Basic documents / Code of Academic Integrity). In case of violation of the norms of academic integrity during the current and final controls, the 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 grade. (<https://www.vnmue.edu.ua/> general information / Basic documents / Code of Academic Integrity). In case of violation of the norms of academic integrity during the current and final controls, the 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 grade.

**Occupy passes.** Missed classes are practiced in the manner prescribed by the Regulations on the organization of the educational process in VNMU named after M.I. Pirogov (link <https://www.vnmue.edu.ua/> General information / Basic documents) at the time determined by the schedule of works (published on the website of the department <https://www.vnmue.edu.ua/> Department of Biological and General Chemistry # ) to the next teacher. To complete the missed lesson, the student must provide a completed workbook protocol on the relevant topic, take a test and answer questions in writing or orally to the topic of the lesson. The practice of missed lectures is carried out after providing a synopsis of lecture material, or preparing your own presentation on the topic of missed lectures.

**The procedure for admission to the final control** of the discipline is given in the Regulations on the organization of the educational process in in VNMU named after M.I. Pirogov (link <https://www.vnmue.edu.ua/> General information / Basic documents). Students who have not missed missed practical classes and lectures and received an average traditional grade of at least «3» are admitted to the final control.

**Additional individual points.** Individual points in the discipline the student can get for individual work, the amount of which is published on the website of the department in the teaching materials of the discipline, the number of points is determined by the results of IWS according to the Regulations on the organization of educational process in VNMU named after M.I. Pirogov (link <https://www.vnmue.edu.ua/> General information / Basic documents).

**Conflict resolution.** In the event of misunderstandings and complaints to the teacher due to the quality of educational services, assessment of knowledge and other conflict situations, the student must first report their claims to the teacher. If the conflict issue is not resolved, the student has the right to submit an appeal to the head of the department in accordance with the Regulations on the consideration of appeals of applicants for higher education in VNMU named after M.I. Pirogov (<https://www.vnmue.edu.ua/> General information / Basic documents).

**Politics in terms of distance learning.** The procedure for distance learning is regulated by the Regulations on the introduction of elements of distance learning in VNMU named after M.I. Pirogov (<https://www.vnmue.edu.ua/> General information / Basic documents). The main training platforms for

training are Microsoft Team, Google Meets. The procedure for conducting practical classes and lectures, exercises and consultations during distance learning is published on the website of the department (<https://www.vnmu.edu.ua/> Department of Biological and General Chemistry / Bulletin Board).

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

**1. Training resources**

Educational and methodical support of the discipline is published on the website of the department (<https://www.vnmu.edu.ua/> Department of Biological and General Chemistry / Educational and methodical materials). Consultations are held twice a week according to the consultation schedule.

**2. The schedule and distribution of groups by teachers** is published on the web page of the department (<https://www.vnmu.edu.ua/> Department of Biological and General Chemistry / Educational and methodical materials).

**3. Questions to the intermediate and final controls of the discipline** are published on the web page of the department (<https://www.vnmu.edu.ua/> Department of Biological and General Chemistry / Educational and methodical materials)

The syllabus on the subject «Medical Chemistry» was discussed and approved at the meeting of the Department of Biological and General Chemistry (Minutes № 1, from «27» August 2021).

Responsible for the course

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*(signature)*

Shunkov V.S.

Head of Department

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*(signature)*

Zaichko N.V.