National Pirogov Memorial Medical University, Vinnytsia

"APROVE "
Vice - Rector for Academic Affairs
_____Prof. Y.I. Guminskiy
"_31_" _August_2020_year

" AGREED "
Head of the Department of the Biological and General Chemistry Department
_____ prof. N.V. Zaichko
"_28_" _August_2020_year

SYLLABUS
of academic discipline
"MEDICAL CHEMISTRY"

Specialty	222 Medicine
Educational level	Master's degree
Educational programme	EPP «Medicine», 2020
Academic year	2020-2021
Department	Biological and General Chemistry Department
Lecturer (if lectures are given)	MD, PhD., prof. Melnyk A.V.
Contact information	*biochem@vnmu.edu.ua,* *str. Pirogova, 56 (Morphological Building), (0432) 570271*
Syllabus compiler	MD, PhD., prof. Melnyk A.V.

1. Status and structure of the discipline

Discipline status	Compulsory
Discipline code in EPP/ discipline place in EPP	EC 13, component of the cycle of general training disciplines
Course / semester	Eg, 1 rd year (I semester)
The amount of discipline (the total number of hours / number of credits ECTS)	*Eg,* 120 hours / 4 credits ECTS
Number of content modules	Lectures - 18 hours Practical classes 44 hours Independent work 58 hours In general: classroom classes - 51.7%, independent extracurricular work - 48.3%
The structure of the discipline	4
Language of study	Ukrainian
Form of study	Full - time (at introduction of quarantine measures - remote)

2. Description of the discipline

Short annotation of the course, relevance.
The program of the discipline "Medical Chemistry" is made in accordance with the order of preparation of 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 the medical student 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 necessary for use in the study of disciplines that explain the processes of life in theoretical and clinical departments.
Postrequisites. Knowledge, skills and abilities acquired after completing the study of medical chemistry are the basis for further study of biological chemistry, pharmacology, normal and pathological physiology, medical physics, medical biology, 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;
to be able: use theoretical knowledge to perform practical tasks related to the analysis of processes in vitro and in vivo;
to able demonstrate: knowledge and practical skills in the discipline;
have skills: work in chemical laboratories during the analysis of drugs and biological fluids;

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

4. Content and logistic of the discipline

Module 1. Homogeneous and heterogeneous equilibria in biological systems	1st semester 120 hours / 4 credits	Lectures №№ 1-9 Practical training №№ 1-22 Topics for self-study №№ 1-14

The course includes 18 topics (studied in 22 practical classes), which are combined into one module (structured into four content modules).

Module 1. Homogeneous and heterogeneous equilibria in biological systems.

Topic 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. Biogenic s-elements: chemical properties, biological role, application in medicine
Topic 3. Biogenic p-elements: chemical properties, biological role, application in medicine
Topic 4. Biogenic d-elements: chemical properties, biological role, application in medicine
Topic 5. Complexation in biological systems
Topic 6. Ways to express the concentration of solutions. Preparation of solutions.
Topic 7. Acid-base balance in the body. Hydrogen pH of biological fluids.
Topic 8. The method of neutralization. Alkalimetry. Acidimetry.
Topic 9. Buffer systems, classification and mechanism of action. Buffer capacity. The role of buffer solutions in biosystems.
Topic 10. Colligative properties of solutions. Osmosis.
Topic 11. Thermal effects of chemical reactions, the direction of processes
Topic 12. Kinetics of biochemical reactions. Chemical equilibrium. The product of solubility
Topic 13. Potentiometric method of analysis. Determination of (redox) potential
Topic 14. Sorption of biologically active substances at the liquid-gas interface
Topic 15. Sorption of biologically active substances at the solid-solution interface. Ion exchange. Chromatography
Topic 16. Obtaining, purification, properties of colloidal solutions. Coagulation of colloidal solutions. Colloidal protection.
Topic 17. Properties of solutions of biopolymers.
Topic 18. Differential 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 Rf
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.
- Calculation of pH change of acid and base solutions after dilution.
- Determination of pH of solutions formed after mixing solutions of acids and bases.
- Calculation of pH of buffer systems.
- Calculation of the ratio of the components of buffer systems.
- Determination of buffer capacity by acid and alkali.
- Calculation of osmotic pressure of solutions of non-electrolytes and electrolytes.
- Determination of depression of electrolyte and non-electrolyte solutions.
- Calculations of the thermal effect of the reaction on the standard heat of formation and combustion of reagents and reaction products.
- Calculation of the change in the free Gibbs energy of the reaction by the change in the free Gibbs energy of reagents and products. Assessment of the possibility of spontaneous reactions.
- Determination of the change in the reaction rate when changing the concentration of reagents.
- Calculation of the change in the reaction rate when the temperature changes. Determination of temperature coefficient.
- Calculation of the reaction equilibrium constant for the equilibrium concentrations of reagents and products.
- Calculation of the product of the solubility of a sparingly soluble compound.
- Assembly of galvanic cells and calculations of their EMF.
- Determination of pH of solutions by potentiometric method.
- Calculations of redox potential.
- Determining the 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, elaboration 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 of materials: Department of Biological and General Chemistry / Educational and methodical materials / 1 course / Medicine / Medical Chemistry / Ukrainian / or by the 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.

5. Forms and methods of monitoring academic performance

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 - differential test	Methods: test control, oral examination and solution of calculation problems (according to the regulations on the organization of the educational process in National Pirogov Memorial Medical University, Vinnytsia) (link https://www.vnmu.edu.ua/General information / Basic documents)
Tools for diagnosing learning success	Theoretical questions, tests, calculation problems, practical tasks, demonstration of practical skills

6. Assessment criteria

Assessment of knowledge is carried out in accordance with the Regulations on the organization of the educational process in National Pirogov Memorial Medical University, Vinnytsia (link https://www.vnmu.edu.ua/General information / Basic documents)

Current control	According to the four-point system of traditional assessments: 5 “excellent”, 4 “good”, 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 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 1 to 12 points From 122 to 200 points in total.

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 credit test
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	is not credited with the possibility of reassembling
1-60	F	unsatisfactory with a mandatory reexamination of discipline	is not credited with mandatory reexamination of discipline

Criteria for assessing student knowledge
Assessment of oral / written response during the current control

The grade “**EXCELLENT**” is given to a student who took an active part in discussing the most difficult questions on the topic of the lesson, gave at least 90% correct answers to standardized test tasks, solved situational problems without mistakes, performed practical work, drew up a protocol, fully substantiated the results.
The grade **“GOOD”** is given to a student who participated in the discussion of the most difficult questions on the topic of the lesson, gave at least 75% correct answers to standardized test tasks, made some minor mistakes in solving situational problems, did practical work and drew up a protocol, but not fully substantiated the obtained data.

The grade **"SATISFACTORY"** is given to a student who did not participate in the discussion of the most difficult questions on the topic, gave at least 60% correct answers to standardized test tasks, made significant mistakes in answering written tasks, solves situational problems, performed practical work and drew up a report, but did not fully substantiate the data obtained.
The grade **"UNSATISFACTORY"** is given to a student who did not participate in the discussion of more complex questions on the topic, gave less than 60% of correct answers to standardized test tasks, made gross mistakes in answering written tasks or did not answer them at all, did not do practical work and did not draw up a protocol, cannot interpret its results.

Assessment of practical skills during the current control

The grade **"excellent"** is given to a student who knows the course and sequence of independent teaching and research work to perform a practical task, seeks the best options for setting up a chemical experiment, demonstrates the correct implementation of the necessary practical skills, and correctly formulates generalizations and conclusions.
The grade **"good"** is given to a student who admits inaccuracies in the performance of chemical research, but is able to identify errors and can demonstrate the implementation of practical skills in general, accurately draws up the results of research in the protocol of practical training.
Assessment of **"satisfactory"** is given to a student who knows the basics of the practical task, but has difficulty performing a chemical study, can not demonstrate the correct sequence of practical skills, can not fully interpret the results of research, sloppily draws up the protocol.
The grade **"unsatisfactory"** is given to a student who can not demonstrate the performance of practical skills, experiences significant difficulties in performing chemical research, violates the procedure for practical work, does not register the progress of work in the protocol.

Evaluation of test tasks during the current control

The grade **"excellent"** is given to the student who at carrying out test control is allowed no more than 10% of incorrect answers (volume of correct answers 90-100%).
The grade **"good"** is given to the student who during the test control makes no more than 20% of errors (the volume of correct answers is 80-89%).
The grade **"satisfactory"** is given to a student who makes mistakes in no more than 40% of test tasks (the amount of correct answers is 60,5-79%).
A grade of "**unsatisfactory**" is given to a student who correctly solves less than 60% of the test tasks in a test survey.

Evaluation of the oral answer during the final control (differential test)

The grade "**EXCELLENT**" is given to a student who gave at least 90% of correct answers to standardized test tasks, solved situational problems without errors, gave thorough complete answers to all theoretical questions. During the differential test the student demonstrates a comprehensive and deep mastering of the curriculum; has full theoretical knowledge and practical skills; understands the general biological and medical significance of the discipline, its connection with professionally-oriented disciplines; mastered the basic and additional educational literature, lecture course.
The grade **"GOOD"** receives a student who gave at least 75% of correct answers to standardized test tasks, made some minor mistakes in solving situational problems, gave complete answers to all theoretical questions with minor errors. During the differential test, the student demonstrates full mastery of the curriculum; has good theoretical knowledge and practical skills; understands the general biological and medical significance of the discipline, its connection with professionally-oriented disciplines; mastered the basic educational literature and lecture course.
The grade **"SATISFACTORY"** receives a student who gave at least 55% correct answers to standardized test tasks, made significant mistakes in answering written tasks, solves situational problems with errors, did not fully answer theoretical questions or made significant mistakes. During

the differential test, the student demonstrates mastering only the basics of the curriculum; mastered not all practical skills; cannot independently explain the connection of medical chemistry with other professionally-oriented disciplines; not fully mastered the educational literature and lecture course.
The grade **"UNSATISFACTORY "** receives a student who gave less than 55% correct answers to standardized test tasks, made gross errors in answering written tasks and theoretical questions or did not give answers to them at all. During the differential test, the student demonstrates a lack of systematic knowledge and skills, has no practical skills, makes fundamental mistakes in answering theoretical questions and in solving situational problems, has not mastered the basic literature and lecture course.

The calculation of individual points is carried out on the basis of the Regulations on the organization of the educational process at V National Pirogov Memorial Medical University, Vinnytsia, 2020). (link https://www.vnmu.edu.ua/General information / Basic documents)

12 points – are added to the assessment of the discipline of a student who won a prize at the interuniversity Olympiads in the discipline or a prize at the All-Ukrainian competition of student research papers or a prize at the interuniversity / international scientific conference with the availability of printed work.

11 points – are added to the assessment of the discipline of a student who won first place in the intra-university Olympiad in the discipline or first place in a student scientific conference with the presence of printed work, or participated in the All-Ukrainian competition of student research papers.

10 points – are added to the assessment of the discipline of the student who won a prize (II-III) at the intra-university Olympiad in the discipline or at a student scientific conference with the availability of printed work; or for participation (without a prize place) in interuniversity competitions in the discipline or a prize place in an interuniversity / international scientific conference with the availability of printed work.

9 points – are added to the assessment of the discipline of the student who participated (without a prize) in the intra-university Olympiad in the discipline or student scientific conference with the presence of printed work.

8 points – are added to the assessment of the discipline of a student who actively participated in the student scientific circle, published a paper on the results of scientific and practical research, but did not personally participate in the student scientific conference, prepared a poster report.

6-7 points – are added to the assessment of the discipline of a student who has made at least 3 tables or a video to supplement the visual support of teaching the discipline (taking into account the volume and importance of the work performed).

3-5 points are added to the assessment of the discipline of a student who has made at least 2 tables, or created a thematic illustrated presentation (at least 2) to supplement the visual support of teaching the discipline (taking into account the volume and importance of work performed).

7. Policy of academic 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 VNMU named after M.I. Pirogov and the principles of academic integrity (link https://www.vnmu.edu.ua/General information).

Adherence to the rules of VNMU, safety techniques in practical classes.
Instruction on biosafety training, 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 Register. 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 gown, 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 should be kept in order and cleaned after the practical work.

Usage of mobile phones and other electronic devices. The use of mobile phones and other electronic devices in the classroom is allowed only during electronic testing or surveys.

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.vnmu.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 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 VNMU named after M.I. Pirogov (link https://www.vnmu.edu.ua/General information) at the time of work out schedule (published on the website of the department https://www.vnmu.edu.ua/ department https://www.vnmu.edu.ua/ of Biological and General Chemistry #) regular 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 writing an abstract, or preparing your own presentation on the topic of missed lectures.

The procedure for admission to the discipline final control is given in the Regulations of the Academic process in VNMU named after M.I. Pirogov (link https://www.vnmu.edu.ua/General information). 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 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 IRS according to the Regulations on the organization of educational process in VNMU named after M.I. Pirogov (link https://www.vnmu.edu.ua/ General information / Basic documents).

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.vnmu.edu.ua/ General information).

Politics in terms of remote 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.vnmu.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 teachers is via messengers (Viber, Telegram, WhatsApp) or e-mail (at the teacher's choice) during working hours.

8. **Educational resources.**
   Educational and methodological support of the discipline is published on the website of the department (https://www.vnmu.edu.ua/ department of Department of Biological and General Chemistry / Bulletin board / for students). Consultations are held twice a week according to the schedule.

1. Educational resources:
   1. Медична хімія: підручник / В.О. Калібабчук, І.С. Чекман, В.І. Галинська та ін. - 4-е видання Автори: В.О. Калібабчук, І.С. Чекман, В.І. Галинська та ін.; за ред.проф. В.О. Калібабчук – К.: ВСВ «Медицина», 2019. – 336 с.
   2. Смірнова О.В., Заічко Н.В., Мельник А.В., Сулім О.Г. Медична хімія (в таблицях, схемах, питаннях, відповідях, прикладах). – Вінниця, «ФОП Корзун Д.Ю.», 2018. – 133.
   3. Zaichko N.V., Smirnova O.V., Chervyak M.M., Shunkov V.S. Medical chemistry. – Vinnytsia, Nilan-LTD, 2017.- 299.
2. Additional literature:
   1. Kalibabchuk V.A., Halinska V.I., Hryshchenko V.I., Hozhdzynskyi S.M., Ovsiannikova T.A., Samarskyi V.A. Medical Chemistry. - K. : Medicine. - 2010.
   2. Смірнова О.В., Сулім О.Г. Кольорові реакції в медичній та органічній хімії. Методичний посібник.– 2017 р.
   3. Смірнова О.В., Сулім О.Г. Елементи якісного та кількісного аналізу. Методичний посібник.– 2014 р.
3. Electronic resources:
   1. E-mail address of the university website: http://vnmu.edu.ua
   2. E-mail address of the university library website: http://library.vnmu.edu.ua
   3. website address of the department: http: // biochem.vsmu.edu.ua/

9. **The timetable and distribution of groups with assigned teachers** are published on the web page of the department ((https://www.vnmu.edu.ua/ department of Biological and General chemistry / Educational and methodical materials / for students).

10. **Questions to the final semester control of the discipline** are published on the web page of the department (https://www.vnmu.edu.ua / department of Biological and General chemistry / for students).

The syllabus of the discipline “Medical Chemistry” was discussed and approved at the meeting of the department Biological and General chemistry (record № 1, dated “27” August 2020)

Responsible for the academic discipline  Melnyk A.V.

Head of the department  Zaichko N.V.