



Syllabus of the discipline "Microorganisms in biotechnological processes"

1. Background information	
Name of faculty	Pharmacy
Educational program (industry, specialty, level of higher education, form of education)	22 Healthcare, 226 Pharmacy, second (Master's) level of higher education, full-time
Academic Year	2022-2023
Discipline name , code (electronic address at the Danylo Halytsky LNMU web page)	"Microorganisms in biotechnological processes"; http://new.meduniv.lviv.ua/kafedry/kafedra-mikrobiologiyi/
Department name, address, phone, e-mail)	Department of Microbiology Zelena 12 street. +38 (032) 276-28-36 Kaf_microbiology@meduniv.lviv.ua
Chair of the department <i>Contact Email</i>)	Prof. O.Korniychuk, MD O. Korniychuk o_korniychuk@ukr.net
Educational year (year of the discipline study) discipline	2nd year of study
Semester (semester in which it is implemented Course objectives)	IV Semester
Type of discipline / module (<i>mandatory / optional</i>)	optional
Teaching staff names, surnames, scientific degrees and titles of teachers who teach <i>Contact Email</i>)	Pavliy S. -Ph.D. Assoc. Professor; microvirus60@ukr.net
Erasmus yes / no (availability of the discipline for students within the Erasmus + program)	No
Person in charge syllabus (<i>the person who should comment on the syllabus contact e-mail</i>)	Pavliy S. -Ph.D. Assoc. Professor; microvirus60@ukr.net

No. of credits in ECTS	3.0 ECTS credits
Number of hours (lectures / seminars)	lectures - 10 hours seminars - 20 hours
Study language	English
Information on consultations	MISA system, according to the schedule of consultations set out on the website, information stands of the department on the site, information stands of the department
Address, telephone Address, telephone and regulations of the clinical base, as needed	-

2. Short annotation to the course

The subject of study of the discipline is the properties of microorganisms that allow their use in biotechnological processes (features of the genetic apparatus, metabolic activity, reproduction rate, etc.).

At the present stage, microorganisms can be used both as vectors and as a source for obtaining tools needed in genetic engineering (enzymes, individual genetic structures, etc.). Biotechnological processes are the most rational way to obtain a number of biologically active substances and drugs. Especially important is the use of biotechnology in the manufacture of vaccines.

Therefore, in the course "Microorganisms in biotechnological processes" it is important for students to learn the basic principles of biotechnological and genetic engineering technologies.

3. Objective and tasks of the discipline

The purpose of the course - professional training of students majoring in "Pharmacy, Industrial Pharmacy" in order to form and develop their competencies in the field of biotechnological processes, aimed at obtaining the necessary theoretical knowledge and skills in practical microbiology, useful for understanding and mastering the discipline.

The discipline "Microorganisms in biotechnological processes" lays the foundations for students to study the principles of biotechnological processes, which are based on knowledge of disciplines acquired in previous courses, provides for the integration of teaching with these disciplines and application of the acquired knowledge in the process of further study and in professional activity. The study is directly based on the following disciplines: medical biology, medical and biological physics, general biology, botany, biological chemistry, bioorganic chemistry, physiology.

Learning Objectives:

- Interpret the biological properties of microorganisms, which is the basis for their use in biotechnological processes.
- Identify methods and tools of biotechnological processes.
- Be able to plan and determine the sequence of stages of genetic engineering technologies.
- Interpret the results of genetic engineering technologies, determine ways to optimize the conditions of biotechnological production.

Competences and learning outcomes nthe formation of which provides the study of the discipline (general and special competencies).

The discipline provides students with the acquisition of competence: ability to solve typical and complex specialized problems and practical problems in professional activities in the field of health care, or in the learning process, which involves microbiological research and / or innovation and is characterized by complexity and uncertainty of conditions and requirements

common : The ability to use knowledge in practice Self-regulation and healthy lifestyles; the ability to adapt and act in a new situation Choosing a communication strategy; ability to work in a team; interpersonal skills. Skills in the use of information and communication technologies.

Ability to think abstractly, analyze and synthesize, to be able to learn and to be modernly taught Determination and perseverance in terms of tasks and responsibilities. Ability to act socially responsibly and with public awareness. The desire to preserve the environment Universal competencies that do not depend on the subject area, but are important for the successful further professional and social activities of the applicant in various fields and for his personal development.

special (professional, subject): -Evaluation of laboratory and instrumental research results Ability to plan and organize production related to biotechnology.

Ability to process state, social, economic and medical information. Evaluation of the impact of socio-economic and biological determinants on the health of the individual, family, population

Ability to apply scientifically substantiated psychological methods of effective work with colleagues, medical staff, patients and their relatives, readiness to interact with other people

4. Prerequisites of the discipline

For successful training and mastering of competencies in this discipline, the basic knowledge obtained by students in the study of medical biology, genetics, medical and biological physics, general and biological chemistry, bioorganic chemistry, normal physiology.

5. Program Learning Outcomes

Description of learning outcomes

Result code training	The content of the learning outcome	Link to competency matrix
<i>is created when filling the syllabus (category: Kn-knowledge, Ability, C-competence, AU - autonomy and Responsibility</i>	<i>Learning outcomes determine that the student must know, understand and be able to perform, after completing the discipline. be able to perform, after completing the study of the discipline. Learning outcomes follow from the set learning goals. To enroll in the discipline, it is necessary to confirm the achievement of each learning outcome.</i>	Software code symbol learning outcomes in the Standard of Higher Education
<i>Kn-1</i>	Have specialized conceptual knowledge acquired in the learning process.	<i>PR2</i>
<i>Kn-2</i>	Have specialized knowledge about features of the immune response, know	<i>PR2</i>

	standard methods of conducting laboratory and instrumental research, genetics of microorganisms, their variability. Amplification methods. (Bacteriological testing)	
<i>Kn-3</i>	Know the principles, tools and tools used in biotechnology processes.	<i>PR13</i>
<i>Kn-4</i>	Know the principles of organizing events preventing the spread of biologically hazardous factors in typical conditions and during emergencies.	<i>PR13</i>
<i>Kn-5</i>	Know standard methods, including modern computer information Ability to process state, social, economic and medical information.	<i>PR12</i>
<i>Kn-6</i>	Know the socio-economic and biological determinants that affect health of people; types and methods of prevention to prevent the negative impact of socio-economic factors on health of the population and its separate groups	<i>PR13, PR19</i>
<i>Kn-7</i>	Know the Law of Ukraine "On combating the spread of diseases caused by the virus human immunodeficiency (HIV), legal and social protection of people living with HIV ". On Amendments to Selected Legislative Acts of Ukraine to Prevent the Emergence and Spread of Coronavirus Disease (COVID-19)	<i>PR13</i>
<i>Ab-1</i>	Be able to solve complex problems and problems that arise in the professional activity.	<i>PR4</i>
<i>Ab-2</i>	Be able to analyze the results of laboratory and instrumental research and on their basis to evaluate the information on obtaining the relevant product.	<i>PR12</i>
<i>Ab-3</i>	Be able to determine the source of finding the necessary information depending on its type; be able to conduct statistical processing of the material and analysis of the obtained information.	<i>PR2, PR4</i>
<i>Ab-4</i>	Be able to assess the relationship and impact of socio-economic and biological determinants on the health of the individual, family, population Be able to plan preventive measures to prevent the negative impact of socio-economic factors on the health of the population and its individual groups	<i>PR13</i>

<i>Ab-5</i>	Be able to identify potential threats to the living organisms.	<i>PR13, PR19</i>
<i>Ab-6</i>	Take into account the diversity of human and civil rights citizen.	<i>PR2</i>
<i>C-1</i>	The ability to apply knowledge in practical situations.	<i>PR2</i>
<i>C-2</i>	Ability to evaluate results Methods of laboratory and instrumental examination.	<i>PR12</i>
<i>C-3</i>	Ability to plan preventive and anti-epidemic measures for Features of infectious diseases.	<i>PR13</i>
<i>C-4</i>	Ability to process state, social, economic and medical information.	<i>PR12</i>
<i>C-5</i>	The ability to assess the impact of social economic and biological determinants of the health of the individual, family, population.	<i>PR13</i>
<i>C-6</i>	Ability to apply intelligent opportunities and knowledge at work.	<i>PR8</i>
<i>AU-1</i>	Responsible for making decisions in difficult conditions.	<i>PR13</i>
<i>AU-2</i>	Be responsible for acceptance decisions on evaluation of laboratory and instrumental results surveys.	<i>PR12</i>
<i>AU-3</i>	Be responsible for quality and to be responsible for high-quality and timely execution of statistical processing and analysis of the obtained information	<i>PR8, PR12</i>
<i>AU-4</i>	Be responsible for the validity of preventive measures prevention of the negative impact of socio-economic factors on health of the population and its separate groups	<i>PR13</i>
<i>AU-5</i>	Make effective decisions, including extreme conditions, and be responsible for them.	<i>PR13</i>

6. Discipline format and scope

Discipline format (specify full-time or part-time)	Full-time	
Sessions	Number hours	Group Numbers
lectures	10	
practical		
Seminars	20	
Self education work	60	

7. Discipline content

Code	Topic	Topic content	Code	Teacher
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sessions			result in training	
L-1 (lecture-1)	Biotechnology as a new branch of science. History, subject and tasks of biotechnology.	Lecture presentation using multimedia support. Outlining problematic issues. Providing answers to question	<i>Kn-1, Kn-5, Ab-5, Ab-7, C-1, C-2, C-5,</i>	assoc. prof. Pavliy S
L-2	Biology of microorganisms that are the basis for use in biotechnological processes. Microorganisms in genetic engineering technologies.	Presentation of lecture material using multimedia support. Outlining problematic issues. Providing answers to questions and solutions to problems.	<i>Kn-1, Kn-5, Ab-5, Ab-7, C-1, C-2, C-5,</i>	assoc. prof. Pavliy S
L-3	Principles of receipt biologically active substances using biotechnological processes: vitamins, hormones, valuable organic substances.	Lecture presentation using multimedia support. Outlining problematic issues. Providing answers to question	<i>Kn-1, Kn-3, Kn-6, Ab-3, C-1, C-4, C-5,</i>	assoc. prof. Pavliy S
L-4	Fundamentals of biotechnology and genetic engineering.	Presentation of lecture material using multimedia support. Outlining problematic issues. Providing answers to questions and solutions to problems.	<i>Kn-1, Kn-2, Kn-3, Kn-5, Kn-6, Kn-7 Ab-3, Ab-4, Ab-6, C-1, C-3, C-4, C-5, C-6 AU-1, AU-2, AU-3, AU-4, AU-5 AB-6, AB-7, AB-8</i>	assoc. prof. Pavliy S.
L-5	Prospect Of obtaining drugs for HIV prevention and COVID-19. treatment	Presentation of lecture material using multimedia support. Outlining problematic issues.	<i>Kn-1, Kn-2, Kn-3, Kn-4, Kn-5, Kn-6, Kn-7, Ab-2, Ab-3, Ab-4, Ab-6, C-1, C-2, C-3, C-4, C-5, C-6</i>	Assoc. prof Pavliy S.

		problematic issues Providing answers to question	<i>AU-1, AU-2, AU-3, AU-4, AU-5</i>	
S.1 (<i>seminar 1</i>)	Peculiarities of genetic apparatus of bacteria. Research methods.	1. Testing of the mastering of the list of questions from the lesson plan. 2. Discussion of issues for self-control. 3. Solving test tasks. 4. Solving situational tasks. 5. Determining the level of formation of a particular skill or ability. 6. Registration of the protocol of lesson. 7. Finding out the problematic issues summing up the lesson.	<i>Kn-1, Kn-5, Ab-5, Ab-6, C-1, C-2, AU-5,</i>	Assoc. Prof. Pavliy S.
S.2	Types of variability. Genetic recombination in bacteria. Classical and modern research methods.	1. Assimilation check the mastering of the list of questions from the lesson plan. 2. Discussion of issues for self-control. 3. Solving test tasks. 4. Solving situational tasks. 5. Determining the level of formation of a particular skill or ability. 6. Registration of the protocol of lesson. 7. Finding out the problematic issues summing up the study	<i>Kn-1, Kn-5, Ab-5, Ab-7, C-1, C-2, AU-5,</i>	Assoc. Prof. Pavliy S.

S. 3.	<p>Planning of genetic engineering task.</p> <p>Basic tools of biotechnology and genetic engineering.</p>	<p>1. Testing the mastering of the list of questions from the lesson plan.</p> <p>2. Discussion of issues for self-control. 3. Solving test tasks. 4. Solving situational tasks.</p> <p>5. Determining the level of formation of a particular skill or ability.</p> <p>6. Registration of the protocol of lesson.</p> <p>7. Finding out the problematic issues summing up the lesson.</p>	<p><i>Kn-1, Kn-5, Ab-5, Ab-7, C-1, C-2, AU-1,</i></p>	<p>Assoc.Prof. Pavliy S.</p>
S. 4.	<p>Design and selection recombinant DNA molecules.</p>	<p>1. Assimilation check the mastering of the list of questions from the lesson plan.</p> <p>2. Discussion of issues for self-control. 3. Solving test tasks. 4. Solving situational tasks.</p> <p>5. Determining the level of formation of a particular skill or ability.</p> <p>6. Registration of the protocol of lesson.</p> <p>7. Finding out the problematic issues summing up the study</p>	<p><i>Kn-1, Kn-5, Ab-5, C-1, C-2, AU-1, AU-2</i></p>	<p>Assoc Prof. Pavliy S.</p>
S. 5	<p>Features of basic microbiological productions</p>	<p>Testing the mastering of the list of questions from the lesson plan.</p>	<p><i>Kn-1, Kn-5, Ab-5, Ab-7, C-1, C-2, AU-5,</i></p>	<p>Assoc. Prof. Pavliy S.</p>

	(producers, raw materials, stages of the industrial process, the use of the finished product): ethanol, acetone, butanol, acetic and citric acids, amino acids, antibiotics.	2. Discussion of issues for self-control. 3.Solving test tasks. 4. Solving situational tasks. 5. Determining the level of formation of a particular skill or ability. 6. Registration of the protocol of lesson. 7. Finding out the problematic issues summing up the lesson.		assoc. prof. Pavliy S.
S. 6.	Reorganizing microorganisms. Ways to increase the efficiency of production of biologically active substances.	1. Assimilation check the mastering of the list of questions from the lesson plan. 2. Discussion of issues for self-control. 3.Solving test tasks. 4. Solving situational tasks. 5. Determining the level of formation of a particular skill or ability. 6. Registration of the protocol of lesson. 7. Finding out the problematic issues summing up the study	<i>Kn-1, Kn-5, Ab-1, Ab-2, Ab-3, C-1, C-2, AB-2, AB-3</i>	Assoc. Prof. Pavliy S.
S. 7.	Genetically modified microorganisms as producers of new drugs. Biologically active substances and Hormones.	1. Testing the mastering of the list of questions from the lesson plan. 2. Discussion of issues for self-control. 3. Solution	<i>Kn-1, Kn-2, Kn-3 Ab-1, Ab-2, Ab-3, Ab-6, C-1, C-2, AU-1, AU-2, AU-3, AU-5</i>	assoc. prof. Pavliy S.

	<p>biotechnological in production. Solution of ecological problems and biotechnology of microorganisms.</p>	<p>Evaluation of test tasks: 4. Solving situational tasks. 5. Determining the level of formation of a particular skill or ability. 6. Registration of the protocol of lesson. 7. Finding out the problematic issues summing up the lesson.</p>		
S. 8.	<p>Stages of formation Of cell engineering. Types of hybrid cells and methods of their production. Eukaryotic cell culture. Hybrid technology is a vivid example of biotechnology coming into practice.</p>	<p>1. Testing the mastering of the list of questions from the lesson plan. 2. Discussion of issues for self-control. 3. Solving test tasks. 4. Solving situational tasks. 5. Determining the level of formation of a particular skill or ability. 6. Registration of the protocol of lesson. 7. Finding out the problematic issues summing up the study</p>	<p><i>Kn-1, Kn-2, Kn-3</i> <i>Kn-5, Kn-6, Kn-7</i> <i>Ab-3, Ab-4, Ab-6,</i> <i>C-1, C-5, C-6,</i> <i>AU-2, AU-3,</i> <i>AU-4</i></p>	Assoc Prof. Pavliy S.
S. 9	<p>Methods of obtaining bioregulators and other biotechnological products for use in medicine.</p>	<p>1. Testing the mastering of the list of questions from the lesson plan. 2. Discussion of issues for self-control. 3. Solving test tasks. 4. Solving test tasks.</p>	<p><i>Kn-1, Kn-2, Kn-5</i> <i>Kn-6, Kn-7,</i> <i>Ab-1, Ab-2, Ab-3,</i> <i>C-1, C-5, C-6, AU-2, AU-5</i></p>	Assoc. Prof. Pavliy S.

		<p>5. Determining the level of formation of a particular skill or ability.</p> <p>6. Registration of the protocol of lesson.</p> <p>7. Finding out the problematic issues summing up the lesson.</p>		
S. 10.	Methods of obtaining vaccines by applying biotechnology. The main directions of obtaining vaccines for the prevention of coronavirus infection	<p>1. Testing the mastering of the list of questions from the lesson plan.</p> <p>2. Discussion of issues for self-control. 3. Solving test tasks. 4. Solving situational tasks.</p> <p>5. Determining the level of formation of a particular skill or ability.</p> <p>6. Registration of the protocol of lesson.</p> <p>7. Finding out the problematic issues summing up the study</p>	<i>Kn-1, Kn-2, Kn-5, Ab-1 Ab-2, Ab-3, C-1, C-2, C-5, AU-2, AU-4, AU-5</i>	Assoc. Prof. Pavliy S.
SEW-1 <i>Self Education Work 1)</i>	Stage Milestones of biotechnology as a science.	<p>Working on the list of questions of the lesson.</p> <p>Preparing answers to questions for self-control.</p>	<i>Kn-1, Kn-5, Ab-5, C-1</i>	Assoc. Prof. Pavliy S.
SEW-2	Characteristics of microorganisms as classical objects for use in biotechnological processes.	<p>Working on the list of questions of the lesson.</p> <p>Preparation of answers to questions for self-control.</p>	<i>Kn-1, Kn-5, C-1</i>	

SEW-3	Metabolism of bacteria. Protein, hydrocarbon, lipid and mineral metabolism. Practical use of enzymal properties of bacteria.	Working on the list of questions of the lesson. Preparation of answers to questions for self-control.	<i>Kn-1, Kn-5, Ab-5, Ab-7, C-1, C-2, AU-5,</i>
SEW-4	Organization of the genetic material of the bacterial cell; bacterial chromosomes, plasmids, migrating elements	Working on the list of questions of the lesson. Preparation of answers to questions for self-control.	<i>Kn-1, Kn-5, Ab-5, Ab-7, C-1, C-2, AU-5,</i>
SEW-5	Modification variability, its mechanisms and forms of manifestation in bacteria. Dissociation.	Working on the list of questions of the lesson. Preparation of answers to questions for self-control.	<i>Kn-1, Kn-5, Ab-5, Ab-7, C-1, C-2, AU-5,</i>
SEW-6	Genetic Variability in mutations and recombination . Essence, classification, manifestations.	Working on the list of questions of the lesson. Preparation of answers to questions for self-control.	<i>Kn-1, Kn-2, Kn-5, Ab-7, K-2</i>
SEW-7	Patterns of flow of biotechnological processes; basic principles of regulating the parameters of biotechnological processes.	Working on the list of questions of the lesson. Preparation of answers to questions for self-control.	<i>Kn-1, Kn-2, Kn-5, Kn-7, Ab-1, Ab-2, C-1, C-2, C-5,</i>
SEW-8	The concept of monoclonal antibodies. Hybrid Technologies	Working on the list of questions of the lesson. Working on the answers	<i>Kn-1, Kn-2, Kn-5, Ab-2, Ab-5, C-1, C-2, C-5, AU-2, AU-4, AU-5</i>

		Questions For self test	
SEW-9	Phage in microbiology and medicine. Use in biotechnological processes.	Working on the list of questions of the lesson. Preparation of answers to questions for self-control.	<i>Kn-1, Kn-4, Kn-6 Ab-2, Ab-3, Ab-4, Ab-6, C-1, C-2, C-3, C-4, C-6 AU-1, AU-2, AU-3, AU-4, AU-5</i>
SEW-10	Use Of biotechnology for the manufacture of antibiotics. Requirements for microorganisms-producers of antibiotics	Working on the list of questions of the lesson. Preparation of answers to questions for self-control.	<i>Kn-1, Kn-2, Kn-3 Kn-4, Kn-5, Kn-6, Kn-7, Ab-1, Ab-2, Ab-3, Ab-4, Ab-5, Ab-6, Ab-7, Ab-8, C-1, C-2, C-3, C-4, C-5, C-6 C-7, AU-1, AU-2, AU-3, AU-4 AU-5, AU-6, AU-7, AU-8</i>
SEW-11	Quality assessment of recombinant vaccines. Advantages over vaccines obtained by the classical method.	Working on the list of questions of the lesson. Preparation of answers to questions for self-control.	<i>Kn-1, Kn-2, Kn-3 Kn-4, Kn-5, Kn-6, Kn-7, Ab-1, Ab-2, Ab-3, Ab-4, Ab-5, Ab-6, C-1, C-2, C-3, C-4, C-5, C-6 C-7, AU-1, AU-2, AU-3, AU-4</i>
SEW-12	Characteristics Of the main directions of obtaining the vaccine for the prevention of COVID-19 infections	Working on the list of questions of the lesson. Preparation of answers to questions for self-control.	<i>Kn-1, Kn-2, Kn-3 Kn-4, Kn-5, Kn-6, Kn-7, Ab-1, Ab-2, Ab-3, Ab-4, Ab-5, Ab-6, Ab-7, Ab-8, C-1, C-2, C-3, C-4, C-5, C-6 C-7, AU-1, AU-2, AU-3, AU-4 AU-5, AU-6, AU-7, AU-8</i>

SEW-13	Using biotechnology for manufacture of probiotic drugs.	Working on the list of questions of the lesson. Preparation of answers to questions for self-control. For self test	<i>Kn-1, Kn-2, Kn-3</i> <i>Kn-4, Kn-5, Kn-6, Kn-7,</i> <i>Ab-1, Ab-2, Ab-3, Ab-4, Ab-5, Ab-6,</i> <i>C-1, C-2, C-3,</i>
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			<i>C-4, C-5, C-6 AU-1, AU-2, AU-3, AU-4</i>
SEW-14	Prospects for application biotechnology for food creation.	Working on the list of questions of the lesson. Preparation of answers to questions for self-control. For self test	<i>Kn-1, Kn-2, Kn-5, Kn-6, Kn-7, Ab-5, Ab-6, C-1, C-2, C-5, C-6</i>
SEW-15	Transgenic Technologies Biosafety issues.	Working on the list of questions of the lesson. Preparation of answers to questions for self-control.	<i>Kn-1, Kn-2, Kn-3 Kn-4, Kn-5, Kn-6, Kn-7, Ab-1, Ab-2, Ab-3, Ab-4, Ab-5, Ab-6, C-1, C-2, C-3, C-4, C-5, C-6 AU-1, AU-2, AU-3, AU-4, AU-5</i>
In the educational process in teaching the discipline "Microorganisms in biotechnology processes "using traditional teaching methods: verbal, visual, practical; methods of educational and cognitive activity: explanatory and illustrative, problematic presentation, search, research, methods of stimulation and motivation of educational and cognitive activity, methods of control and self-control (control and correction by the teacher, self-control and self-correction, mutual control and mutual correction).			

8. Description of learning outcomes

In-process control

Topic mastery (current control) is checked during practical classes in accordance with specific objectives. Practical skills control is implemented on the basis of the manufacture and research of microscopic drugs, determination of morpho-tinctoryal, cultural, biochemical and antigenic properties of microorganisms, study of their factors of pathogenicity, establishment of sensitivity to antimicrobial agents, setting and interpretation of the results of serological reactions, interpretation of the results of microbiological study of various clinical material, as well as the study of microflora of external ser edovyshcha. The assessment is carried out by directly controlling the teacher's performance of the student's skills, as well as using illustrated tests.

At each practical lesson, students' knowledge is evaluated according to the four-score system ("5", "4", "3", "2") according to the criteria for assessing the current activity of the student.

Evaluation of student's Self Education Work.

The material for the independent work of students, which is provided in the topic of practical training simultaneously with classroom work, is evaluated during the current control of the topic at the appropriate classroom. Evaluation of topics that are submitted for independent study and are not included in the topics of classroom training sessions is carried out during the final control (exam).

Code	Code type of lessons	Verification method	Criteria
Of result training		outcomes training	Of admission
<i>Kn-1</i>	L-1, L-2, L-3, L-4, L-5 S-1, S-2, S-3, S-4, S-5, S-6, S-7, S-8, S-9, S-10 SEW-1, SEW-2, SEW-3, SEW-4, SEW-5, SEW-6, SEW-7, SEW-8, SEW-9 SEW-10, SEW-11, SEW-12, SEW-13, SEW-14, SEW-15	Visiting Of lectures and practical classes Performing written tasks to the topic (test tasks, questions for self-control, situational tasks). Demonstration of practical skills.	For admission It is necessary to enroll in the discipline to full compliance with the requirements of the curriculum; correct solution of tasks both during classroom work and those offered for independent study.
<i>Kn-2</i>	L-1, L-2, L-3, L-4, S-1, S-2, S-3, S-4, S-5, S-6, S-7, S-8, S-9, S-10 SEW-6, SEW-7, SEW-8, SEW-9 SEW-10, SEW-11, SEW-12, SEW-13, SEW-14, SEW-15	Execution of practical training protocols.	Excellent ("5") - The student answers 90-100% of the tests correctly.
<i>Kn-3</i>	L-3, L-4, L-5, S-1, S-2, S-3, S-4, S-5, S-6, S-7, S-8, S-9, S-10 SEW-10, SEW-11, SEW-12, SEW-13, SEW-14, SEW-15	Participate in discussions, discussion of issues submitted for independent processing.	100% tests. Correctly, clearly, logically and fully answers all questions. Can closely link theory and practice, correctly demonstrates the implementation of practical skills. Solves situational problems of increased complexity, is able to summarize the material, has research methods to the extent necessary for the activities of the pharmacist. Good ("4") – The student correctly answered 71-89% of the tests.
<i>Kn-4</i>	L-5 S-1, S-2, S-3, S-4, S-5, S-6, S-7, S-8, S-9, S-10 SEW-9, SEW-10, SRS-11, SRS-12, SRS-13, SRS-14,	Students' Self Educational Work is assessed during the current control of the topic in the relevant lesson.	Correctly and in essence answered the question. Demonstrates the implementation of practical skills. Correctly uses theoretical knowledge in solving practical problems. He knows how to solve light and medium complexity situational problems.
<i>Kn-5</i>	L-1, L-2, L-4, L-5, S-1, S-2, S-3, S-4, S-5, S-6, S-7, S-8, S-9, S-10 SEW-1, SEW-2, SEW-3, SEW-4, SEW-5, SEW-6, SEW-7, SEW-8, SEW-10, SEW-11, SEW-12, SEW-13, SEW-14, SEW-15	Topics listed only for independent work, students are processed in a separate school, the performance is checked by the teacher and their enrollment is recorded in the academic journal.	
<i>Kn-6</i>	L-3, L-4, L-5, P-8, P-9, P-12, P-14, P-15, P-16, P-17, P-18, P-18, P-20, P-21, P-22, P-23, P-24, P-25, P-26, P-27, P-28 SEW-9, SEW-10, SEW-11, SEW-12, SEW-13 SEW-14, SEW-15, SEW-16, SEW-17, SEW-18, SEW-19, SEW-20, SEW-21, SEW-22, SEW-23, SEW-24, SEW-25, SEW-26,	For current knowledge control	
<i>Ab-1</i>	L-1 L-2 S-1, S-2, S-3, S-4, S-5, S-6, S-7,		

	S-8, S-9, S-10 SEW-7, SEW-10, SRS-11, SRS-12, SRS-13, SRS-14,	students created For the current control of students' knowledge, test tasks have been created, which contain standard tests on the topic of the lesson (including tests with several correct answers), theoretical questions, which include questions from the lecture course and questions from independent work; situational tasks (with 3 questions); practical skills according to the topic of the lesson.	Has the necessary practical skills and methods of their implementation to the extent exceeding the required minimum. Satisfactory ("3") – The student correctly answered 60-70% of the tests. Incompletely, with the help of additional questions, answers questions. Cannot independently build a clear, logical answer. During the response and demonstration of practical skills, the student makes mistakes. The student solves only the easiest tasks, has only a mandatory minimum of research methods.
Ab-2	L-5, L-6, L-7, L-8, L-9, L-10, P-10, P-11, P-13, P-14, P-15, P-16, P-17, P-18, P-19, P-20, P-21, P-22, P-23, P-24, P-25, P-26, P-27, P-28, SEW-7, SEW-8, SEW-9, SEW-10, SEW-11 SEW-12, SEW-13, SEW-14, SEW-16, SEW-17, SEW-18, SEW-19, SEW-20, SEW-21, SEW-22, SEW-23, SEW-24, SEW-25, SEW-26	3 practical skills in accordance with the topic of the lesson. <i>Evaluation of test tasks:</i> Excellent ("5") - The student answers 90-100% of the tests correctly. 100% tests. Good ("4") – The student correctly answered 71-89% tests. Satisfactory ("3") - The student correctly answered 60-70% tests. Unsatisfactory ("2") – The student answered less than 60% of the tests.	Unsatisfactory ("2") – The student answered less than 60% of the tests. Does not know the material of the current topic, can not build a logical answer, does not answer additional questions, does not understand the material. During the response and demonstration of practical skills, the student makes mistakes.
Ab-3	L-3, L-4, L-5, L-6, L-7, L-8, L-9, P-8, P-12, P-16, P-17, P-18, P-19 P-20, P-21, P-22, P-23, P-24, P-25, P-26, P-27, SEW-9, SEW-10, SEW-11, SEW-12, SEW-13 SEW-14, SEW-16, SEW-17, SEW-18, SEW-19, SEW-20, SEW-21, SEW-22, SEW-23, SEW-24, SEW-25, SEW-26,	<i>Evaluation of test tasks:</i> Excellent ("5") - The student answers 90-100% of the tests correctly. 100% tests. Good ("4") – The student correctly answered 71-89% tests. Satisfactory ("3") - The student correctly answered 60-70% tests. Unsatisfactory ("2") – The student answered less than 60% of the tests.	Unsatisfactory ("2") – The student answered less than 60% of the tests. Does not know the material of the current topic, can not build a logical answer, does not answer additional questions, does not understand the material. During the response and demonstration of practical skills, the student makes mistakes.
Ab-4	L-4, L-5, L-6, L-7, L-8, L-9, P-8, P-12, P-16, P-17, P-18, P-19 P-20, P-21, P-22, P-23, P-24, P-25, P-26, P-27, SEW-9, SEW-10, SEW-11, SEW-12, SEW-13 SEW-14, SEW-16, SEW-17, SEW-18, SEW-19, SEW-20, SEW-21, SEW-22, SEW-23, SEW-24, SEW-25, SEW-26,	Satisfactory ("3") - The student correctly answered 60-70% tests. Unsatisfactory ("2") – The student answered less than 60% of the tests.	Unsatisfactory ("2") – The student answered less than 60% of the tests.
Ab-5	L-1 L-2 S-1, S-2, S-3, S-4, S-5, S-6, S-7, S-8, S-9, S-10 SEW-1 SEW-3 SEW-4 SEW-5 SEW-8 SEW-10 SEW-11 SEW-12 SEW-13 SEW-14 SEW-15	Unsatisfactory ("2") – The student answered less than 60% of the tests.	Unsatisfactory ("2") – The student answered less than 60% of the tests.
Ab-6	L-4, L-5, L-6, L-7, L-8, L-9, S-1, S-2, S-3, S-4, S-5, S-6, S-7, S-8, S-9, S-10 SEW-9, SEW-10, SRS-11, SRS-12, SEW-13, SEW-14, SEW-15,	Unsatisfactory ("2") – The student answered less than 60% of the tests.	Unsatisfactory ("2") – The student answered less than 60% of the tests.
C-1	L-1, L-2, L-3, L-4, L-5, L-6, L-7, L-8, L-9, L-10,	Unsatisfactory ("2") – The student answered	

		less than 60% of the tests. <i>Practical skills assessment:</i>	
	P-1, P-2, P-3, P-4, P-5, P-6, P-7, P-8, P-9, P-10, P-11, P-12, P-13, P-14, P-15, P-16, P-17, P-18, P-19 P-20, P-21, P-22, P-23, P-24, P-25, P-26, P-27, P-28 P-29, SEW-1, SEW-2, SEW-3, SEW-4, SEW-5, SEW-7, SEW-8, SEW-10, SEW-11, SEW-12, SEW-13 SEW-14, SEW-15, SEW-16, SEW-17, SEW-18, SEW-19, SEW-20, SEW-21, SEW-22, SEW-23, SEW-24, SEW-25, SEW-26, SEW-27	"5" - demonstration of skills correct, complete; "4" - "4" - demonstration of skills with 2-3 minor errors; "3" - demonstration of skills with 1 significant, gross error or more than 3 minor mistakes.	
C-2	L-1, L-2, L-5 L-6, L-7, L-8, L-9, L-10 P-1, P-2, P-3, P-4, P-5, P-6, P-7, P-10, P-11, P-13, P-14, P-15, P-16, P-17, P-18, P-19, P-20, P-21, P-22, P-23, P-24, P-25, P-26, P-27, P-28, P-29, SEW-3, SEW-4, SEW-5, SEW-6, SEW-7, SEW-8, SEW-9, SEW-10, SEW-11, SEW-12, SEW-13, SEW-14, SEW-15, SEW-16, SEW-17, SEW-18, SEW-19, SEW-20 SEW-21, SEW-22, SEW-23, SEW-24, SEW-25, SEW-26, SEW-27	"2" - "2" - demonstration of skills is completely wrong or with 2 or more gross mistakes. <i>Evaluation of the theoretical question: "5" -</i>	
C-3	L-4, L-5, S-1, S-2, S-3, S-4, S-5, S-6, S-7, S-8, S-9, S-10 SEW-9, SEW-10, SRS-11, SRS-12, SEW-13, SEW-14, SEW-15,	the answer is correct, complete; "4" - the answer is correct, incomplete; "3" - answer with errors, incomplete;	
C-4	L-3, L-4, L-5, S-1, S-2, S-3, S-4, S-5, S-6, S-7, S-8, S-9, S-10 SEW-9, SEW-10, SRS-11, SRS-12, SEW-13, SEW-14, SEW-15,	"2" is not essentially illogical.	

C-5	L-3, L-4, L-5, S-1, S-2, S-3, S-4, S-5, S-6, S-7, S-8, S-9, S-10 SEW-7, SEW-8, SEW-9 SEW-10, SEW-11, SEW-12, SEW-13, SEW-14, SEW-15	Assessment of situational problem: "5" - correct, complete answers to all questions; "4" - correct, complete answers to two questions; "3" is the correct, complete answer to one question;	
C-6	L-4, L-5,		
	S-1, S-2, S-3, S-4, S-5, S-6, S-7, S-8, S-9, S-10 SEW-9, SEW-10, SRS-11, SRS- 12, SEW-13, SEW-14, SEW-15,	for one question "2" - the answers to all questions are wrong or missing.	
AU-1	L-4, L-5, L-6, L-7, L-8, L-9, L-10, P-12, P-16, P-17, P-18, P-19, P- 20, P-21, P-22, P-23, P-24, P- P-26, P-27 SEW-9, SEW-10, SEW-11, SEW- 12, SEW-13 SEW-14, SEW-16, SEW-17, SEW-18, SEW-19, SEW-20, SEW-21, SEW-22, SEW-23, SEW-24, SEW-25, SEW-26,		
AU-2	S-1, S-2, S-3, S-4, S-5, S-6, S-7, S-8, S-9, S-10 SEW-8, SEW-9, SEW-10, SRS-11, SRS-12, SEW-13, SEW-14, SEW- 15,		
AU-3	L-4, L-5, L-6, L-7, L-8, L-9, P-8, P-12, P-16, P-17, P-18, P- 19 P-20, P-21, P-22, P-23, P- 24, P-25, P-26, P-27, SEW-9, SEW-10, SEW-11, SEW- 12, SEW-13 SEW-14, SEW-16, SEW-17, SEW-18, SEW-19, SEW-20, SEW-21, SEW-22, SEW-23, SEW-24, SEW-25, SEW-26,		
AU-4	L-3 L-4, L-5, S-1, S-2, S-3, S-4 S-5, S-6, S-7, S-8, S-9, S-10 SEW-8, SEW-9, SEW-10, SRS- 11, SRS-12, SEW-13, SEW-14, SEW-15,		

AU-5	L-1, L-2, L-4, L-5, S-1, S-2, S-3, S-4, S-5, S-6, S-7, S-8, S-9, S-10, SEW-3, SEW-4, SEW-5, SEW-8 SEW-9, SEW-10, SRS-11, SRS-12, SEW-13, SEW-14, SEW-15,	
Final control		
Total Evaluation System.	Participation in the work during the semester on a 200-point scale	
Scales of assessing	traditional 4-point scale, multi-scale (200-points) scale, rating scale ECTS	
Experimental admission to the final control	The student attended all practical (laboratory, seminar) classes and received at least 120 points for current success	
Species summary IO control	Methodology of final control	Criteria Of admission
	All topics submitted to the In-process control Scores from the 4-point scale are converted to points on a multi-point (200-point) scale in accordance with the Regulations "Criteria, rules and procedures for assessing learning outcomes of students	Max Number of points - 200 Min Number of points - 120

(national) scale during the study of discipline, by calculating the arithmetic mean (CA), rounded to two decimal places. The resulting value is converted into points on a multi-point scale as follows:

$$= \frac{CA * 200}{5}$$

9. Policy of discipline

Academic integrity. During the scientific-pedagogical process, students (applicants) and teachers are obliged to follow the Code of Academic Ethics of the Danylo Halytsky Lviv National Medical University, as a document that defines the standards generally accepted by the world community for the implementation of educational and scientific activities by applicants of higher education and university employees and creates an environment of intolerance to violations of academic integrity and ethics of academic relationships. <https://nauka.meduniv.lviv.ua/wp-content/uploads/kodeks-akademichnoyi-etiki-2021.pdf> The organization of the educational process is carried out on the basis of the credit-transfer system with the use of rating evaluation of students' success. Inadmissible: copying and plagiarism; absences and lateness to classes; using a mobile phone, tablet or other mobile devices during class (except for cases provided for by the curriculum and methodical recommendations of the teacher); untimely completion of tasks set by the teacher during the current, final control of knowledge, as well as independent work of students. The discovery of signs of academic dishonesty in a student's work is a reason for the teacher not to enroll it, regardless of the scale of plagiarism or deception. https://nauka.meduniv.lviv.ua/wp-content/uploads/2019/11/plagiat_viyavlennya-ta-sanktsiyi-dlyazdobuvachiv.pdf Any form of violation of academic integrity will not be tolerated. In case of such events, respond in

accordance with the Code <https://nauka.meduniv.lviv.ua/wp-content/uploads/kodeks-akademichnoyi-etiki-2021.pdf> The procedure and algorithm of the appeal. The student has the right to get acquainted with the results of his examination (credit) written work no later than 2 working days after its writing and to receive an explanation of the received grade. In case of procedural violations, disagreement with the assessment, the student has the right to submit a written appeal to the head of the department, indicating the specific reasons for disagreement with the assessment. The appeal procedure and the evaluation rules and procedures are described in detail in the Regulations on Evaluation Rules and Procedures Criteria. The appeal regarding the results of the final control of the knowledge of the students of higher education is a component of the organizational support of the educational process, which is carried out to determine the objectivity of the given assessment. The main task of the appeal procedure is to overcome the elements of subjectivism during the evaluation of knowledge, to avoid misunderstandings and controversial situations, to create the most favorable conditions for the development and real provision of the legal rights and interests of the student. The head of the department together with the examiner, involving other specialists, forms a commission to consider the issue of compliance with the procedure and within three working days ensures consideration of the appeal and verbally informs the student of the results of the review. In the case of confirmation of the circumstances stated in the student's application, by order of the rector (vice-rector for scientific and pedagogical work), a new control event is held with a different composition of the commission.

10. Reference

Mandatory.

1. Medical microbiology, virology and immunology=Медична мікробіологія, вірусологія та імунологія : a textbook for English-speaking students of higher medical schools: translation from ukr. Published / [T.V. Andrianova, V.V. Bobyr, V.V. Danyleichenko, ect.] ed. by V. P. Shyrobokov. Vinnitsia: Nova Knyha, 2019. - 744 p. : ill.
2. Medical microbiology, virology and immunology=Медична мікробіологія, вірусологія та імунологія : підручник / Тимків М.З., Корнійчук О.П., Павлій С.Й. [та ін.]. – Вінниця: Нова Книга, 2019. – 416 с.
3. Levinson W. Review of medical microbiology and immunology. McGraw-Hill Medical, 2017. – 710 p.
12. Murray P. R., Rosenthal, K. S., Pfaller, M. A. Medical microbiology. Elsevier Health Sciences. – 848 p.
4. Atlas R. M. Principles of microbiology.-McGraw-Hill, Boston, Massachusetts, 2001
5. Microbiology and immunology on-line <http://www.microbiologybook.org/>
6. On-line microbiology note <http://www.microbiologyinfo.com/>
- Centers for diseases control and prevention www.cdc.gov

Links to professional periodicals:

1. https://fems-microbiology.org/about_fems/network-and-activities/journals/
2. <https://elibrary.escmid.org/>; <https://www.escmid.org/escmid-publications/manual-of-microbiology>
3. <https://asm.org/a/Microcosm-Digital-Magazine>
4. Microbiological journal <https://microbiolj.org.ua/ua/archiv>
5. The world of medicine and biology
<https://womab.com.ua/ua/arcive>
6. Microbiology and biotechnology <http://mbt.onu.edu.ua/issue/archive>
7. Regulatory mechanisms in Biosystems
<https://medicine.dp.ua/index.php/med/issue/archive>

11. Equipment, material, technical and software discipline / course

Access to the Internet

Panasonic multimedia interactive projector, launched in 2013 TVs – 2 pcs.

Luminescent microscope LUMAM R-8 MBI-6 (900213) - № 1

Autoclave

Dry heater Fridges

Analytical scales VLR-200 - №1

Thermostat TS-80 M - No 5 Dosings 10-1000.0 mkl from 3 quarter 2016 --

№ 4 Petri dishes, bacteriological loops, tweezers

Disks with antibiotics - №50

Measuring utensils

Nutrient media Endo, BA, MPA, MPB YSA, Saburo.

Burners

12. Additional information

Lectures and practical classes are held at: 79005, Lviv, 12 Zelena street Zelena 12 street.

Responsible for educational and methodical work in the specialty "Pharmacy, Industrial Pharmacy" at the department - Pavliy S.assoc.prof.PhD

Responsible for the educational process at the department - Assoc. prof. Shykula R.

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Responsible for the scientific club of the department - Assoc. Prof. Panas M.

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Students are allowed to practice only in a medical bathrobe, cap and replaceable shoes.

Syllabus compiler

Pavliy S.assoc.prof.PhD

(Signature)

Head of the Department
of Microbiology Korniychuk O

(Signature)