EDUCATIONAL PROGRAM
MICROBIOLOGY, VIROLOGY AND IMMUNOLOGY

for students

branch of knowledge 22 «Healthcare»
speciality 222 «Medicine»
preparation program «Master of Medicine»
The work program on the discipline "Microbiology, virology and immunology" for students of speciality 222 "Medicine".

**Lecturers:**
Skivka L.M., ScD. Professor of the Department of Department of Microbiology and Immunology,
Kharina A.V., Ph.D., associate Professor of the Department of Virology,
Faidiuk I.V., Ph.D., assistant Professor of the Department of Department of Microbiology and Immunology

The work program of the discipline "Microbiology, virology and immunology" was considered at the meeting of the Department of Microbiology and Immunology and Department of Virology of the Educational and Scientific Center "Institute of Biology and Medicine".

Protocol № 11, «16» 06 2018
Head of the Department of Virology (Budzanivska I.G.)
«16» 06 2018

Protocol № 15, «15» 06 2018
Head of the Department of Microbiology and Immunology (Skivka L.M.)
«15» 06 2018

Considered by scientific and methodical commission of Educational and Scientific Center "Institute of Biology and Medicine" of Taras Shevchenko National University of Kyiv.
Use of 100-point scale is approved

Protocol № 7, «21» 06 2018
Head of Scientific and Methodical Commission (Skrypnyk N.V.)
«21» 06 2018

**APPROVED**
Deputy Director for scientific and pedagogical work (Department of Medicine)
Kharchenko O.I.
«21» 06 2018

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1. Annotation.

Program of the discipline "Microbiology, virology and immunology" is the program developed in accordance with the project of standard for higher education of Ukraine for the second (master's) level of higher education in the field of knowledge 22 "Health" specialty 222 "Medicine", discussed at the XIII Ukrainian Scientific and Practical Conference with the international participation "Actual issues of the quality of medical education" (May 12-13 2016, Ternopil) and an exemplary curriculum for the training of specialists in the second (master) level of higher education in the field of knowledge 22 "Health care" in higher education institutions of the Ministry of Health of Ukraine in the specialty 222 "Medicine", educational qualification "Master of Medicine", professional qualification "Physician", approved on July 26, 2016 in. at. Minister of Health V. Safarsky; taking into account the Instruction for evaluation of students' educational activity in the conditions of implementation of the European Credit Transfer System for the organization of the educational process, approved by the Ministry of Health of Ukraine on April 15, 2014.

Description of the discipline. Program of studying discipline "Microbiology, virology and immunology" developed for medical Higher Education Institution of Ukraine in accordance with the requirements of the credit transfer system of the organization of the educational process ECTS, based on a combination of studying technologies according to modules and credit assessment - units of measurement of the student's academic load necessary for the mastering of the discipline or its section.

Types of training in accordance with the curriculum are: a) lectures, b) practical classes, c) independent work of students.

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

Practical classes provide:
1) students studying the morphology and structure of bacteria, conducting serological reactions, experiments on cell cultures, animals and chicken embryos, or on the basis of experiments recorded in movies, films submitted in computer programs and other educational technologies;
2) solution of situational problems (laboratory diagnostics of infectious diseases, evaluation of immunity parameters, sanitary-microbiological assessment of the environment, etc.) with an experimental, clinical-diagnostic or sanitary-hygienic orientation.

Control methods

Current control is based on the control of theoretical knowledge, practical skills and abilities.

Form of current control:
1. Oral questioning (frontal, individual, combined), interview.
2. Practical examination of the formed professional skills by the results of practical work at the end of the class.
3. Test control ("open" and "closed" test tasks)

The final control of the sections is carried out at the end of the section in the form of written control work, which includes test tasks from the Bank "Krok-1", theoretical questions and control of practical skills (solving situational tasks in human genetics, defining and describing micro- and microsamples, etc.).

The objective of the course is the properties of pathogenic representatives of microbe world, their interaction with the human organism, mechanisms of infectious diseases development, methods of their diagnosis, specific prevention and treatment.
Interdisciplinary connections:

The study of the discipline "Microbiology, virology and immunology" (specialty 222 "Medicine", educational qualification "Master of Medicine", professional qualification "Physician" is carried out in IV semester of 2nd year of studying and is based on knowledge of the basic natural sciences disciplines: medical biology, medical and biological physics, biological and bioorganic chemistry, human anatomy, histology, cytology and embryology, Latin language, history of medicine, philosophy and integrates with these disciplines. It provides the basis for students to study general hygiene, epidemiology, pathological physiology, pathological anatomy, immunology and allergology, infectious diseases, internal diseases, surgical diseases and childhood illnesses and other clinical disciplines, which involves the integration of teaching with these disciplines and the application of knowledge in microbiology, virology and immunology in the process of further education and professional activity. Develops the doctrine of physiological role of microbes in the human organism and the prevention of violation of these functions in the process of medical interventions.

The course program is structured on 2 modules, which include blocks of content modules.

1. Course tasks and aims
1.1. The purpose of the study of microbiology, virology and immunology - the final goals are established on the basis of education program in speciality for the training of physicians according to content module (natural - scientific training) and is the basis for construction of the discipline content. The description of goals is formulated through skills in the form of target tasks (actions).

Based on the ultimate goals, specific goals in the form of certain skills (actions), target tasks are formulated according specific module content and provide the achievement of the ultimate goal of studying.

1.2. The main tasks of studying the discipline "Microbiology, virology and immunology" are:
To interpret the biological properties of pathogenic and non-pathogenic microorganisms, viruses and patterns of their interaction with macroorganism, human population and the environment.
- To determine methods of microbiological and virological diagnostics, etiotropic therapy and specific prophylaxis of infectious diseases.
- To explain the structure of the immune system of the human body.
- To interpret the basic mechanisms of development an immune response in the human body.
- To determine the main types of pathological reaction of the immune system and the relationship with the emergence of the most common human diseases.

1.3. Competencies and study results, forming of which is facilitated by the discipline (connections between the study content for higher education applicants formed in the terms of study results in The Standard). According to the standard requirements the discipline provides the competences obtained by students:

-Integral: the ability to solve both typical and more complicated special assignments and practical problems during professional activities or study, to apply obtained knowledge, skills, abilities, as well as personal qualities, abilities and values for problem solving of any level during professional activities or study.
-Common: - Ability to apply knowledge in practical situations. Ability to realize self-regulation, healthy lifestyle, ability to adapt and act in a new situation. Ability to choose a communication strategy; ability to work in a team; interpersonal skills. Implementation of skills
in information and communication technologies. Ability to abstract thinking, analysis and synthesis, the ability to learn and to be modernly trained. Determination and persistence on the tasks and duties. Ability to act socially responsible and with public consciousness. The desire to save the environment. Universal competencies that do not depend on the subject area but are important for successful further professional and social activities of the applicant in various fields and for his personal development.

- *special* (professional, objective): - Ability to evaluate the results of laboratory and instrumental studies. Ability to perform sanitary and preventive measures. Ability to plan preventive and anti-epidemic measures to control infectious diseases. Ability to process state, social, economic and medical data. Ability to assess an impact of socio-economic and biological factors on the health of the individual, family, population levels.

Ability to apply scientifically grounded psychological methods of effective work with colleagues, medical staff, patients and their relatives, readiness to interact with. Personal awareness of other people culture.

List and content of competence

<table>
<thead>
<tr>
<th>№</th>
<th>Competence list</th>
<th>Competence content</th>
<th>Competence types</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Integral</td>
</tr>
<tr>
<td>1</td>
<td>Communicative</td>
<td>Integrative capacity, based on the humanistic personal qualities and directed to provide the effectiveness of communicative activities, according to the experience in the communication, training level, education and development</td>
<td>+</td>
</tr>
<tr>
<td>2</td>
<td>Cognitive</td>
<td>The level of individual cognitive activity, which corresponds to the existing system of principles, values, methods of cognition in the culture of society.</td>
<td>+</td>
</tr>
<tr>
<td>3</td>
<td>Intelligent</td>
<td>A special type of knowledge organization, which provides the opportunity to make effective decisions, including in extreme conditions</td>
<td>+</td>
</tr>
<tr>
<td>4</td>
<td>Intellectual-corporative</td>
<td>Complex psychological property of a person, characterized by a set of skills and abilities, adequate to the importance of optimization tasks</td>
<td>+</td>
</tr>
<tr>
<td>5</td>
<td>Informative</td>
<td>Personal ability to apply, find, store and convert different data. This is the ability to work with different information systems.</td>
<td>+</td>
</tr>
<tr>
<td>6</td>
<td>Technological</td>
<td>System of creative and technological knowledge, abilities and stereotypes of activity on transformation of medical reality objects with the help of technical means</td>
<td>+</td>
</tr>
<tr>
<td>7</td>
<td>Cultural</td>
<td>Personal possibility to organize an integral humanitarian educational space, forming a unified image of a culture or a complete picture of the world</td>
<td>+</td>
</tr>
<tr>
<td>8</td>
<td>Psychological</td>
<td>Structured system of knowledge about a person as an individual, a subject of labor and personality, included in an individual or joint activity, carries out</td>
<td>+</td>
</tr>
<tr>
<td>№</td>
<td>Competence</td>
<td>Knowledge</td>
<td>Skills</td>
</tr>
<tr>
<td>----</td>
<td>--------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>9</td>
<td>Psychological medical</td>
<td>A complex of certain qualities (properties) of a person with a high level of preparedness for medical activities and effective interaction with patients during health care</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Professional</td>
<td>The qualitative characteristic for specialists mastering degree in his professional activity which involves: awareness of their motives to this activity, assessment of their personal properties and qualities, regulation of their professional formation, self-improvement and self-education</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Socio-psychological</td>
<td>Mastering of scientifically grounded psychological methods of effective work with colleagues, medical personnel, patients and their relatives, readiness to interact with other people.</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>General cultural</td>
<td>Awareness of the individual in the field of other peoples culture</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Conflict</td>
<td>Professional awareness of the range of possible strategies of conflicting parties and the ability to provide psychological and technological assistance in the implementation of constructive interaction in a particular conflict situation.</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Design / prognostic</td>
<td>Abilities needed to identify tactical and strategic tasks for successful project implementation</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Informational and prognostic</td>
<td>Constructive skills of integral knowledge compositional arrangement</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Organizing</td>
<td>Ability to manage the activity</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Communicative</td>
<td>Communicative skills of influence on subjects of the professional process</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Analytical</td>
<td>Ability to adequately assess the level of their own activities</td>
<td></td>
</tr>
</tbody>
</table>

Specification of competence according to descriptors of NFQ in a form of «Competence Matrix».

<table>
<thead>
<tr>
<th>№</th>
<th>Competence</th>
<th>Knowledge</th>
<th>Skills</th>
<th>Communication</th>
<th>Autonomy and responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The ability to use knowledge in professional activities</td>
<td>To possess specialized conceptual knowledge gained in the learning process</td>
<td>To be able to solve difficult tasks and problems arising in professional activities</td>
<td>A clear and unequivocal report of own conclusions, knowledge and explanations for experts and non-specialists</td>
<td>To carry out responsibilities for making decisions in difficult conditions</td>
</tr>
<tr>
<td>2</td>
<td>Ability to evaluate the results of laboratory and and</td>
<td>To possess specialized knowledge of person, human organs and systems, to know the standard method</td>
<td>To be able analyze the results of laboratory and instrumental tests and, on the their</td>
<td>To prescribe and evaluate the results of laboratory and instrumental tests substantially</td>
<td>To be responsible for making decisions on evaluating the results of laboratory and instrumental studies</td>
</tr>
<tr>
<td>Instrumental Test</td>
<td>Basis, to evaluate the information on the patient's diagnosis (according to the list 4)</td>
<td>(according to the list 4)</td>
<td></td>
<td></td>
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<td>-------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>--------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Ability to develop preventive and anti-epidemic measures to control infectious diseases</td>
<td>To know the principles and systems of planning preventive and anti-epidemic measures in relation to infectious diseases in typical conditions and in conditions of epidemic illness on the basis of the results of the analysis, data of the survey of the cell of infectious diseases. To know prophylactic and anti-epidemic methods of organizing measures to prevent the spread of infectious diseases.</td>
<td>To be able to work on the basis of epidemiological analysis, using preventive and anti-epidemic methods, to plan (draw up plans) measures to prevent the spread of infectious diseases (in list 2).</td>
<td>Inform the population, heads of relevant institutions and enterprises on the timely conduct of preventive and anti-epidemic measures, vaccinations, etc.</td>
<td>To be responsible for qualitative analysis of indicators for infectious morbidity of the population, timely carrying out of appropriate preventive and anti-epidemic measures.</td>
<td></td>
</tr>
<tr>
<td>4. Ability to conduct preventive and anti-epidemic measures to control infectious diseases</td>
<td>To know the principles of organizing and conducting a system of preventive and anti-epidemic measures in relation to infectious diseases and preventing their spread in typical conditions and during an exacerbation of the epidemic situation.</td>
<td>To be able to organize preventive and anti-epidemic measures in relation to infectious diseases in a health facility, among the assigned population and in cells of infectious diseases on the basis of epidemiological analysis according to risk groups, risk areas, time and risk factors.</td>
<td>Inform the leaders of the health care institutions, local authorities on the epidemic situation and the need for timely and qualitative prevention and anti-epidemic measures in the health care facility, among the assigned population and in the cells of infectious diseases.</td>
<td>To be responsible for the quality and timeliness of early diagnosis of infectious diseases, the organization of effective preventive and anti-epidemic measures to prevent the spread of infectious diseases.</td>
<td></td>
</tr>
<tr>
<td>5. Ability to process state, social, economic and medical information</td>
<td>To know standard methods, including modern digital technologies, processing of state. Ability to determine the source of required information.</td>
<td>To form conclusions based on the analysis and statistical processing of the information received.</td>
<td>Be responsible for the quality and timely performance of statistical processing and analysis of received data.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ability to assess the impact of socio-economic and biological determinants on the health of the individual, family, population</td>
<td>To know the socio-economic and biological determinants that affect the health of the population; types and methods of prevention the negative impact of socio-economic factors on the health of the population and its individual groups</td>
<td>To be able to calculate health indicators based on data of epidemiological and medical-statistical researches. To be able to assess the relationship and the impact of socio-economic and biological factors on the health of the individual, family, population. To be able to develop control measures to prevent the negative impact of socio-economic factors on the health of the population and individual groups.</td>
<td>To obtain the necessary information from identified sources regarding the health status of the population and individual groups and formulate conclusions as for impact of socio-economic and biological factors on the population health.</td>
<td>To be responsible for the justification of control measures to prevent the negative impact of socio-economic factors on the health of the population and individual groups.</td>
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</tr>
<tr>
<td>7.</td>
<td>Ability to apply intellectual capabilities and knowledge working with a patient</td>
<td>To know the ideological function of bioethics in the formation of a civil society and the historical aspects of the concept of &quot;human rights&quot;</td>
<td>To be able to identify the potential threats to the essence of living organisms</td>
<td>To make effective decisions, including in extreme conditions, and to be responsible for them</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Ability to provide a medical, ethical and legal assessment of specific cases from the standpoint of confidentiality and medical secrecy in solving situational problems in patients with HIV infection</td>
<td>To know the Law of Ukraine &quot;On the counteraction to the spread of diseases caused by the human immunodeficiency virus (HIV), the legal and social protection of people living with HIV.&quot;</td>
<td>Consider varieties of human rights and citizen</td>
<td>To apply the rules and principles of biomedical ethics and deontology</td>
<td>To be responsible for security medical privacy</td>
</tr>
</tbody>
</table>
Study results:

The integrative final study results that are enhanced by the discipline:

- Ability to analyze the biological properties of pathogenic and non-pathogenic microorganisms, viruses and patterns of their interaction with the macroorganism, with the human population and the environment.
- Ability to interpret the basic mechanisms of immune response formation in human organism.
- Ability to determine the main types of pathological response of the immune system and the association with the emergence of the most common human diseases.
- Ability to determine the methods of microbiological and virological diagnosis, etiotropic therapy and specific prophylaxis of infectious disease.
- Ability to process state, social, economic and medical data.

Discipline Learning outcomes - a complex of knowledge, skills, other competence types acquired by a person in the study process in accordance with the standard of higher education that can be identified, quantified and measured.

According to standard of higher education student should:

know:

In conditions of the medical institution, using the standard procedure, using knowledge about the human organism, human organs and systems, based on the results of laboratory and instrumental studies, evaluate the information on the diagnosis (according to the list 4):
- Serological reactions to diagnosis infectious diseases;
- Microbiological study of biological fluids and extracts;
- Chemical, organoleptic, bacteriological examination of food and water quality.

be able to:

- Evaluate the results of laboratory and instrumental tests on list 4;
- Provide negative consequences of the influence of dangerous factors on the human body;
- Master the modern methods of microbiological research in infection diseases;
- Analyze principles of obtaining vaccine preparations, methods of their standardization and control, practical use;
- Master the principles of obtaining of immune serum, the methods of their standardization, control, practical use;
- Interpret the development of medicine in a historical retrospective;
- Treat the main historical and medical events;
- Demonstrate the moral and ethical principles of the attitude towards the living person, their body as an object of anatomical and clinical research.

2. Information volume of academic discipline

255 hours, 8.5 ECTS credits are allocated for the study of the discipline. The discipline "Microbiology, Virology and Immunology" is structured on 2 modules, which include content module blocks.

255 hours, 8.5 ECTS credits are allocated for the study of the discipline.
Module 1: 165 hours 5.5 ECTS credits.
Module 2: 90 hours 3.0 ECTS credits.
**Description of the discipline "Microbiology, Virology and Immunology" syllabus**

<table>
<thead>
<tr>
<th>Structure of the discipline</th>
<th>Hours, among them</th>
<th>Year of study</th>
<th>Assessment type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>Class</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lectures</td>
<td>Practise class</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>255</td>
<td>30</td>
<td>120</td>
<td>105</td>
</tr>
</tbody>
</table>

**ECTS credits**

<table>
<thead>
<tr>
<th>Module 1 (11 content modules):</th>
<th>165 hours/ 5.5 ECTS credits</th>
<th>20</th>
<th>70</th>
<th>45</th>
<th>2</th>
<th>Final module assessment.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module 2 (3 content modules):</td>
<td>90 hours/ 3.0 ECTS credits</td>
<td>10</td>
<td>50</td>
<td>45</td>
<td>3</td>
<td>Final module assessment.</td>
</tr>
<tr>
<td>Including final assessment of 2 modules mastering.</td>
<td>16 hours/ 0.53 ECTS credits</td>
<td>6</td>
<td></td>
<td>10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: 1 ECTS credit – 30 h
Teaching load – 58.8 %, SIW – 41.2 %.
The average weekly load is 6 hours (0.2 ECTS credit).

**Module 1: Morphology and physiology of microorganisms. Infection. Immunity. General and special virology.**

**Content modules:**
1. Introduction to microbiology.
4. Genetics of microorganisms.
5. Microbiological fundamentals of antimicrobial chemotherapy and antiseptics.
6. Infection.
7. The host immune system. The reactions of nonspecific defence from infectious agents.
8. Antigens, antibodies.
10. General virology.
11. Special virology.

**Module 2: Special, clinical and environmental, and sanitary microbiology.**

**Content modules:**
### 3. Structure of the discipline

**Module 1: Morphology and physiology of microorganisms. Infection. Immunity. General and special virology.**

<table>
<thead>
<tr>
<th>Title of modules and subjects</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>on-campus education</td>
</tr>
<tr>
<td></td>
<td>total including</td>
</tr>
<tr>
<td></td>
<td>l</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

#### Content module 1. Introduction to microbiology.

Subject 1. Subject and tasks of medical microbiology. The original methods of microbiological research. Principal features of modern medical microbiology. Trends in its development.  
3 | 1 | - | - | - | 2 | - | - | - | - | - | - | - | - |

Subject 2. Stages of microbiology development.  
1 | - | - | - | - | 1 | - | - | - | - | - | - | - | - |

**TOTAL IN CONTENT MODULE 1.**  
4 | 1 | - | - | - | 3 | - | - | - | - | - | - | - | - |


5 | - | 3 | - | - | 2 | - | - | - | - | - | - | - | - |

Subject 2. Gram method of microorganism staining.  
6 | - | 3 | - | - | 3 | - | - | - | - | - | - | - | - |

Subject 3. Morphology and structure of bacteria.  
6 | 1 | 3 | - | - | 2 | - | - | - | - | - | - | - | - |

Subject 4. Morphology and structure of spirochetes, actinomycetes, fungi, protozoa.  
5 | - | 3 | - | - | 2 | - | - | - | - | - | - | - | - |

**Total in content module 2.**  
19 | 1 | 12 | 9 | - | - | - | - | - | - | - | - | - | - |

#### Content module 3. Physiology of microorganisms (prokaryotes). Evolution and classification of microorganisms.

Subject 1. Bacterial metabolism. Growth media for culturing  
5 | 0.5 | 1.5 | - | - | 3 | - | - | - | - | - | - | - | - |
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Subject 2.</td>
<td>3.5</td>
<td>1.5</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Subject 3.</td>
<td>5.5</td>
<td>0.5</td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Subject 4.</td>
<td>5</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Subject 5.</td>
<td>5</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Subject 6.</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Content module 4. Genetics of microorganisms.**

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Genetics of microorganisms.</th>
<th>Genetics of microorganisms.</th>
<th>Genetics of microorganisms.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject 1.</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total in content module 4.</td>
<td>3</td>
<td>1</td>
<td>-</td>
</tr>
</tbody>
</table>

**Content module 5. Microbiological fundamentals of antimicrobial chemotherapy.**

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Subject 19.</td>
<td>1</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Total in content module 5.</td>
<td>7</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

**Content module 6. Infection.**

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Infectious process, its forms, conditions of its induction and development.</th>
<th>Infectious process, its forms, conditions of its induction and development.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject 1.</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Total in content module 6.</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

**Content module 7. The host immune system. The reactions of nonspecific defence from microorganisms.**

<table>
<thead>
<tr>
<th>Subjects</th>
<th>The main stages of history of immunology.</th>
<th>The main stages of history of immunology.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject 1.</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Subject 2.</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>
nonspecific defence from pathogenic microorganisms.

| Total in content module 7. | 9 | 1 | 3 | - | - | 5 | - | - | - | - | - |

**Content module 8. Antigens. Antibodies.**

| Subject 1. The characteristic of antigens. | 1 | 3 | - | - | 1 | - | - | - | - | - | - |
| Subject 2. Immunoglobulins as a product of the humoral immune response. | 1 | 2 | - | - | 1 | - | - | - | - | - | - |

| Total in content module 8. | 9 | 2 | 5 | - | - | 2 | - | - | - | - | - |

**Content module 9. Immune reactions. Immunopathology.**

| Subject 1. Reactions of the immune response. Principles of the use of antibodies as treatment- and prophylactic serum and diagnostic serum. | 1 | 3 | - | - | 2 | - | - | - | - | - | - |
| Subject 2. Principles of the use of microbial agents as prophylactic and diagnostic preparations. | 1 | 3 | - | - | 1 | - | - | - | - | - | - |
| Subject 3. Serological tests with labels. | - | 3 | - | - | 3 | - | - | - | - | - | - |
| Subject 4. Immunopathology. The study of the host immune reactivity. | - | - | 1 | - | - | - | - | - | - | - | - |

| Total in content module 9. | 18 | 2 | 9 | - | - | 7 | - | - | - | - | - |

**Content module 10. General Virology**

| Subject 1. Moders methods of infectious diseases diagnosis | - | 2 | - | - | - | - | - | - | - | - | - |
| Subject 2. Morphology and ultrastructure of viruses. Cultivation of viruses in chicken embryos and laboratory animals. | 2 | 3 | - | - | 1 | - | - | - | - | - | - |
| Subject 3. Cell culture in virology. Methods of virul cultivating in cell cultures. Indication of viral reproduction. | - | 3 | - | - | 3 | - | - | - | - | - | - |
Subject 4. Serologic reactions used in virology. | - | 3 | - | - | 1 | - | - | - | - | - |
Subject 5. Genetics of viruses. Bacteriophages, practical application. | - | - | - | - | 1 | - | - | - | - | - |

Total in content module 10. | 19 | 2 | 11 | - | 6 | - | - | - | - | - |

**Content module 11. Special virology**

Subject 1. Orthomyxoviruses. | 1 | 3 | - | - | 3 | - | - | - | - | - |
Subject 2. Paramyxovirus. | - | - | - | - | 2 | - | - | - | - | - |
Subject 3. Picornaviruses. | 1 | 3 | - | - | 1 | - | - | - | - | - |
Subject 4. Retroviruses. HIV. | 1 | 3 | - | - | 1 | - | - | - | - | - |
Subject 5. Other RNA-viruses. | - | - | - | - | 2 | - | - | - | - | - |
Subject 6. Poxviruses, Papilomaviruses, Poliomarises, Parvoviruses. | 0,5 | - | - | - | 1 | - | - | - | - | - |
Subject 7. Herpesviruses. | 1 | 3 | - | - | 1 | - | - | - | - | - |
Subject 8. Adenoviruses. | 0,5 | - | - | - | 1 | - | - | - | - | - |
Subject 10. Cousative agents of viral hepatitis. | 1 | 3 | - | - | 1 | - | - | - | - | - |
Subject 11. Ecological group of Arboviruses. | - | - | - | - | 1 | - | - | - | - | - |
Subject 12. Oncogenic viruses. | - | - | - | - | 2 | - | - | - | - | - |
Subject 13. Prions. | - | - | - | - | 2 | - | - | - | - | - |
Total in content module 11 | 39 | 6 | 15 | - | 18 | - | - | - | - | - |

Final assessment of mastering module 1 – "Morphology and physiology of microorganisms". Infection. Immunity. General and special virology».

Hours – | 165 | 20 | 70 | - | 75 | - | - | - | - | - |

Teaching load – 44,4%; SIW – 55,6 %.

**Module 2: Special, clinical and ecological microbiology.**

<table>
<thead>
<tr>
<th>Title of modules and subjects</th>
<th>Hours</th>
</tr>
</thead>
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<tr>
<td></td>
<td>on-campus education</td>
</tr>
<tr>
<td></td>
<td>total</td>
</tr>
<tr>
<td></td>
<td>l</td>
</tr>
<tr>
<td>Subject</td>
<td>Module</td>
</tr>
<tr>
<td>---------</td>
<td>--------</td>
</tr>
<tr>
<td>Subject 1. Staphylococci and streptococci (Micrococccaceae and Streptococccaceae families).</td>
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</tr>
<tr>
<td>Subject 2. Meningococci and gonococci (Neisseriaceae family).</td>
<td>-</td>
</tr>
<tr>
<td>Subject 3. Escherichia.</td>
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</tr>
<tr>
<td>Subject 4. Salmonella</td>
<td>3</td>
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<tr>
<td>Subject 5. Salmonella - the agents of gastroenterocolitis.</td>
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</tr>
<tr>
<td>Subject 6. Shigella.</td>
<td>3</td>
</tr>
<tr>
<td>Subject 7. Vibrio (Vibrionaceae family)</td>
<td>3</td>
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<tr>
<td>Subject 8. Corynebacteria (Corynebacteriaceae family).</td>
<td>2</td>
</tr>
<tr>
<td>Subject 9. Mycobacteria (Mycobacteriaceae family).</td>
<td>3</td>
</tr>
<tr>
<td>Subject 10. Anaerobic infection agents (Bacillaceae family).</td>
<td>-</td>
</tr>
<tr>
<td>Subject 11. Zoonotic infection agents.</td>
<td>-</td>
</tr>
<tr>
<td>Subject 12. Rickettsia, Chlamydia, Mycoplasma.</td>
<td>-</td>
</tr>
<tr>
<td>Subject 13. Spirochetes.</td>
<td>-</td>
</tr>
<tr>
<td>Subject 14. Pathogenic spirilla.</td>
<td>-</td>
</tr>
<tr>
<td>Subject 15. Anaerobic nonclostridial bacteria.</td>
<td>-</td>
</tr>
<tr>
<td>Subject 16. Causative agent of pertussis.</td>
<td>-</td>
</tr>
<tr>
<td>Subject 17. Gram-negative nonfermenting bacteria.</td>
<td>-</td>
</tr>
<tr>
<td>Subject 18. Other pathogenic bacteria.</td>
<td>-</td>
</tr>
<tr>
<td>Subject 19. Pathogenic fungi and actinomycetes.</td>
<td>-</td>
</tr>
<tr>
<td>Subject 20. Pathogenic protozoa.</td>
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<tr>
<td>Total in content module</td>
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</table>
### Content module 13. Fundamentals of clinical and environmental microbiology

<table>
<thead>
<tr>
<th>Subject</th>
<th>General characteristics of clinical microbiology.</th>
<th>2</th>
<th>3</th>
<th>1</th>
<th>-</th>
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</thead>
<tbody>
<tr>
<td>Subject 22.</td>
<td>Opportunistic infections.</td>
<td>-</td>
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<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Subject 23.</td>
<td>Healthcare acquired infections (clinical, hospital, nosocomial).</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Subject 24.</td>
<td>Ecological microbiology.</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>Total in content module 13.</td>
<td></td>
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<td>2</td>
<td>3</td>
<td>4</td>
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</tbody>
</table>

### Content module 14. Sanitary microbiology and virology

| Subject 26. | Fundamentals of sanitary microbiology. Sanitary microbiology of water, soil and air. | 2 | 2 | 1 | - | - | - | - | - |
| Subject 27. | Sanitary virology. | - | 3 | - | 1 | - | - | - | - |
| Total in content module 14. | | 7 | 2 | 5 | 2 | - | - | - | - |
| Final assessment of mastering module 2 "Special, clinical and environmental microbiology". | - | 3 | - | 5 | - | - | - | - | - |
| Hours – | 90 | 10 | 50 | 30 | - | - | - | - | - |

Teaching load – 66,67%, ISW – 33,33%

### 4. Lecture subjects

<table>
<thead>
<tr>
<th>№</th>
<th>Lecture subject</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The value of medical microbiology in the practice of the physician. History of microbiology. The original methods of microbiological research. Evolution and classification of microorganisms.</td>
<td>2</td>
</tr>
<tr>
<td>4.</td>
<td>The concept of infection.</td>
<td>2</td>
</tr>
<tr>
<td>5.</td>
<td>The history of immunology. The factors of nonspecific defence. The host immune system. Antigens.</td>
<td>2</td>
</tr>
<tr>
<td>6.</td>
<td>Antibodies, structure. The classes of immunoglobulins. Interactions between the cells of the immune system during the immune response.</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No.</th>
<th>SUBJECT</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Structure of bacteriological laboratory. Dyes and simple methods of microorganism staining. Microscopy.</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>Gram method of microorganism staining.</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>Morphology and structure of bacteria.</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>Morphology of spirochetes, actinomycetes, fungi</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>Growth media for culturing microbes. Sterilization.</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>Growth and reproduction of microorganisms. Isolation of pure cultures of bacteria (class 1).</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>Growth and reproduction of microorganisms. Isolation of pure cultures of bacteria (class 2).</td>
<td>3</td>
</tr>
<tr>
<td>8.</td>
<td>Isolation of pure cultures of bacteria (class 3).</td>
<td>3</td>
</tr>
<tr>
<td>9.</td>
<td>Chemotherapeutic drugs. Antibiotics.</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>Factors of nonspecific host defence from microorganisms.</td>
<td>3</td>
</tr>
<tr>
<td>11.</td>
<td>Serological tests (class 1).</td>
<td>3</td>
</tr>
<tr>
<td>12.</td>
<td>Serological tests (class 2).</td>
<td>2</td>
</tr>
<tr>
<td>13.</td>
<td>Serological tests with labels.</td>
<td>3</td>
</tr>
<tr>
<td>14.</td>
<td>Vaccines and immune serum.</td>
<td>3</td>
</tr>
<tr>
<td>15.</td>
<td>Modern microbiological and immunological methods of infectious</td>
<td>2</td>
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</table>

### Module 2: Special, clinical and ecological microbiology.

<table>
<thead>
<tr>
<th>No.</th>
<th>SUBJECT</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Pathogenic cocci.</td>
<td>2</td>
</tr>
<tr>
<td>2.</td>
<td>Pathogenic enterobacteria.</td>
<td>2</td>
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<tr>
<td>3.</td>
<td>Diphtheria and tuberculosis agents.</td>
<td>2</td>
</tr>
<tr>
<td>5.</td>
<td>Fundamentals of Clinical and Sanitary Microbiology.</td>
<td>2</td>
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<tr>
<td>TOTAL</td>
<td></td>
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</tbody>
</table>

**Total hours**: 30

### 5. Seminar class subjects

Seminar classes are not provided.

### 6. Practice class subjects

**Practice class syllabus course 2**

<table>
<thead>
<tr>
<th>No.</th>
<th>SUBJECT</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Structure of bacteriological laboratory. Dyes and simple methods of microorganism staining. Microscopy.</td>
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<tr>
<td>2.</td>
<td>Gram method of microorganism staining.</td>
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<tr>
<td>3.</td>
<td>Morphology and structure of bacteria.</td>
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<tr>
<td>4.</td>
<td>Morphology of spirochetes, actinomycetes, fungi</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>Growth media for culturing microbes. Sterilization.</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>Growth and reproduction of microorganisms. Isolation of pure cultures of bacteria (class 1).</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>Growth and reproduction of microorganisms. Isolation of pure cultures of bacteria (class 2).</td>
<td>3</td>
</tr>
<tr>
<td>8.</td>
<td>Isolation of pure cultures of bacteria (class 3).</td>
<td>3</td>
</tr>
<tr>
<td>9.</td>
<td>Chemotherapeutic drugs. Antibiotics.</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>Factors of nonspecific host defence from microorganisms.</td>
<td>3</td>
</tr>
<tr>
<td>11.</td>
<td>Serological tests (class 1).</td>
<td>3</td>
</tr>
<tr>
<td>12.</td>
<td>Serological tests (class 2).</td>
<td>2</td>
</tr>
<tr>
<td>13.</td>
<td>Serological tests with labels.</td>
<td>3</td>
</tr>
<tr>
<td>14.</td>
<td>Vaccines and immune serum.</td>
<td>3</td>
</tr>
<tr>
<td>15.</td>
<td>Modern microbiological and immunological methods of infectious</td>
<td>2</td>
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</table>
diseases diagnosis.

17. Cultivation of viruses. Indication of viral reproduction. (class 2). 3
18. Serological methods in virology 3
19. Orthomyxoviruses. Laboratory diagnosis of influenza. 3
20. Picornaviruses. Laboratory diagnosis of enterovirus infections. 3
21. Herpesviruses, Adenoviruses. Laboratory diagnosis of herpes and adenoviral infections. 3
22. Causative agents of viral hepatitis. Laboratory diagnosis of viral hepatitis. 3
23. Retroviruses. HIV. Laboratory diagnosis of HIV-infection. 3
24. Final module assessment No. 1 3

TOTAL 70

Practice class syllabus course 3

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<th>No.</th>
<th>SUBJECT</th>
<th>Hours</th>
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<tr>
<td>1.</td>
<td>Staphylococci and streptococci. Microbiological diagnostics of diseases caused by staphylococci and streptococci.</td>
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<tr>
<td>2.</td>
<td>Meningococci and gonococci. Microbiological diagnostics of diseases caused by meningococci and gonococci.</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>Escherichia. Microbiological diagnostics of diseases caused by E. coli.</td>
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</tr>
<tr>
<td>4.</td>
<td>Salmonella. Microbiological diagnostics of typhoid fever, paratyphoid, salmonella gastroenteritis.</td>
<td>3</td>
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<tr>
<td>5.</td>
<td>Shigella. Microbiological diagnostics of dysentery.</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>Vibrio. Microbiological diagnostics of cholera.</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>Corynebacteria. Microbiological diagnostics of diphtheria</td>
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<tr>
<td>8.</td>
<td>Mycobacteria. Microbiological diagnostic of tuberculosis</td>
<td>3</td>
</tr>
<tr>
<td>9.</td>
<td>Causing agents of anaerobic infections. Microbiological diagnostics of anaerobic infections.</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>Zoonotic infection agents. Microbiological diagnostics of zooantropogenous infections.</td>
<td>3</td>
</tr>
<tr>
<td>11.</td>
<td>Rickettsia, Chlamydia, Mycoplasma. Microbiological diagnostics of rickettiosis, chlamiosis and mycoplasmosis.</td>
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<tr>
<td>12.</td>
<td>Spirochetes. Microbiological diagnostics of spirochetosis.</td>
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<tr>
<td>13.</td>
<td>Pathogenic fungi. Microbiological diagnostics of mycoses.</td>
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<td>15.</td>
<td>Sanitary microbiology.</td>
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<td>16.</td>
<td>Sanitary virology.</td>
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<td>17.</td>
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7. Laboratory class subjects
Laboratory class are not provided.

8. Student's Individual Work

<table>
<thead>
<tr>
<th>№</th>
<th>Subject</th>
<th>Hours</th>
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18
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Content modules 1 and 2. &quot;Introduction to microbiology. Morphology and structure of prokaryotes and parasitic unicellular eukaryotes. Microorganism staining. Microscopy.&quot;</strong></td>
</tr>
<tr>
<td>1. Main features and trends of modern microbiology development.</td>
</tr>
<tr>
<td>2. Contribution of native scientists to the development of microbiology in Ukraine.</td>
</tr>
<tr>
<td>3. Dependence of the results of staining of microorganisms on their properties.</td>
</tr>
<tr>
<td>4. Theories explaining the mechanism of Gram stain of different microorganisms.</td>
</tr>
<tr>
<td>5. Methods of detection of structural elements of bacteria: spores, capsules, flagella, inclusions, etc.</td>
</tr>
<tr>
<td>6. Methods of studying the morphology of fungi and actinomycetes.</td>
</tr>
<tr>
<td><strong>Content module 3. Physiology of microorganisms (prokaryotes). Evolution and classification of microorganisms.</strong></td>
</tr>
<tr>
<td>7. Modern growth media for the cultivation of bacteria.</td>
</tr>
<tr>
<td>8. Test system for determining the enzymatic activity of microorganisms.</td>
</tr>
<tr>
<td>9. Origin and evolution of microorganisms. Basic principles of taxonomy of microorganisms.</td>
</tr>
<tr>
<td>10. Modern classification of prokaryotes. Bacterial growth and method of reproduction, the phases of reproduction bacterial culture in stationary conditions.</td>
</tr>
<tr>
<td><strong>Content module 4. Genetics of microorganisms. Content module 5. Microbiological basics of antimicrobial chemotherapy.</strong></td>
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<tr>
<td>12. Genetics of microorganisms.</td>
</tr>
<tr>
<td>13. Modern test systems for determining microbial sensitivity to antibiotics.</td>
</tr>
<tr>
<td><strong>Content module 6. Infection. Content module 7. The host immune system. Reactions of nonspecific defence from microorganisms.</strong></td>
</tr>
<tr>
<td>14. The concept of infection. The role of microorganism, macroorganism and environment in an infection process.</td>
</tr>
<tr>
<td>15. The characteristic of cellular and tissue, physiological and humoral factors of nonspecific defence.</td>
</tr>
<tr>
<td>16. The importance of the complement system for immune defence, the pathways of complement activation.</td>
</tr>
<tr>
<td>17. Bacterial antigenic structure. Autoantigens.</td>
</tr>
<tr>
<td>18. The classes of immunoglobulins and their structure. Autoantibodies. Monoclonal antibodies, their production and use in medical practice.</td>
</tr>
<tr>
<td>19. Immediate and delayed hypersensitivity, the mechanisms and the differences. The practical significance.</td>
</tr>
<tr>
<td>20. Immunological tolerance, the causes of induction.</td>
</tr>
<tr>
<td>21. The three-cell cooperation scheme of induction of the immune response. The role of different cells of the immune system, their interaction. Interleukins.</td>
</tr>
<tr>
<td>22. Immunological memory, its mechanism.</td>
</tr>
<tr>
<td>23. Immunodeficiency disorders, autoimmune processes. Complex study of human immune reactivity.</td>
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</table>
### Content module 10. General virology.

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<tr>
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<tbody>
<tr>
<td>24.</td>
<td>Principles of polymerase chain reaction</td>
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<tr>
<td>25.</td>
<td>History of discovery and the main stages in the development of virology. The contribution of national scientists. Methods of study of viruses and their evaluation.</td>
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<tr>
<td>26.</td>
<td>Modern concept on the nature and origin of viruses. The place of viruses in nature.</td>
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<tr>
<td>27.</td>
<td>Principles of virus classification.</td>
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<tr>
<td>28.</td>
<td>Bacteriophages, morphology and structure. Бактеріофаги, морфологія і структура. Methods of qualitative and quantitative determination of bacteriophages.</td>
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<tr>
<td>29.</td>
<td>Nonspecific defense factors protecting the macro-organism against viral agents, their characteristics. Interferons, mechanism of action, inductors of interferones. Inhibitors of viruses.</td>
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</table>

### Content module 11. Special virology.

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<tbody>
<tr>
<td>30.</td>
<td>Prospects for obtaining of effective influenza vaccines.</td>
<td>3</td>
</tr>
<tr>
<td>31.</td>
<td>The family of Paramyxoviridae – parainfluenza virus, mumps virus, measles virus respiratory syncytial virus.</td>
<td>2</td>
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<tr>
<td>32.</td>
<td>The family of Rhabdoviridae, virus characteristics. Specific prevention of rabies.</td>
<td>1</td>
</tr>
<tr>
<td>33.</td>
<td>General characteristics of the ecological group of arboviruses.</td>
<td>1</td>
</tr>
<tr>
<td>34.</td>
<td>Genus Rubivurus. Rubella virus</td>
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</tr>
<tr>
<td>35.</td>
<td>Smallpox virus</td>
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<tr>
<td>36.</td>
<td>Problems and future perspectives in the development of vaccines for the prevention of viral hepatitis. Modern vaccines.</td>
<td>3</td>
</tr>
<tr>
<td>38.</td>
<td>Prions, properties. Prion diseases</td>
<td>2</td>
</tr>
<tr>
<td>39.</td>
<td>Training for final assessment of mastering module 1</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>75</td>
</tr>
</tbody>
</table>

### Module 2: Special, clinical and ecological microbiology.

### Content module 12. Pathogenic prokaryotes and eukariotes.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>40.</td>
<td>Scarlet fever streptococcus (Streptococcus pyogenes). Streptococcus pneumoniae. Enterococci. Anaerobic Staphylococci and Streptococci.</td>
<td>2</td>
</tr>
<tr>
<td>41.</td>
<td>General characteristics of other representatives of Neisseria family: Moraxella, Acinetobacter, Kingella genera, their role in human pathology.</td>
<td>3</td>
</tr>
<tr>
<td>42.</td>
<td>Salmonella. General characteristics. Kauffman–White classification of salmonella.</td>
<td>1</td>
</tr>
<tr>
<td>43.</td>
<td>Comparative properties of the pathogenic protozoa. Amoebic dysentery agent.</td>
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</tr>
<tr>
<td>44.</td>
<td>Paragemolytic vibrios, properties. The role in human pathology.</td>
<td>1</td>
</tr>
<tr>
<td>45.</td>
<td>Bordetella pertussis. Haemophylus influenzae. Legionella.</td>
<td>2</td>
</tr>
<tr>
<td>46.</td>
<td>Non-sporeforming gram-negative anaerobic bacteria of Bacteroides, Fusobacterium genera. Anaerobic cocci of Peptococcus ans Peptostreptococcus genera. Anaerobic bacteria of Veillonella genus.</td>
<td>3</td>
</tr>
<tr>
<td>47.</td>
<td>The role of native scientists in the preparation of drugs for the</td>
<td>1</td>
</tr>
</tbody>
</table>

20
specific prevention of zooanthropous infections.

48. Comparative properties of rickettsiae, mycoplasmas and viruses. 1

49. General characteristics and classification of undulating forms of microorganisms. Pathogenic spirilla. Campylobacter and Helicobacter genera bacteria. 2

50. Pathogenic fungi and actinomycetes (pathogens of candidiasis, dermatomycosis, actinomycosis, their characteristics). 2

Content module 13. Fundamentals of clinical and environmental microbiology

51. Criteria for the etiological role of opportunistic microorganisms isolated from the pathogenic hearth foci of the patient in clinic. 2

52. Principles of diagnosis and treatment of dysbiosis. 2

Content module 14. Sanitary microbiology and virology

53. Sanitary-virological and bacteriological criteria for assessing water bodies, soil and air in enclosed spaces. 2

Preparation for final assessment of mastering module 2 5

Total 30

Total hours ISW (Module 1+ Module 2) 105

9. Individual tasks

Individual tasks must bear creative and searching character, contributing to student cognitive activity. Students should complete individual tasks by themselves under teacher guidance. They are additional assignments allowing students to deepen their knowledge of a certain discipline, for example a conference speech preparation and thesis prints according to a department scientific topics.

10. Individual Work tasks

<table>
<thead>
<tr>
<th>№ No.</th>
<th>Students' Individual Work topics:</th>
<th>Subject of the class of SIW check and assessment.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Preparation of the students for practical classes - theoretical and design of a working notebook with individual work in out-of-class time</td>
<td>Teaching assistant checks and assesses the SIW at the preparatory stage of the practical class.</td>
</tr>
<tr>
<td>II</td>
<td>Self-study of topics that are not part of the class plan:</td>
<td></td>
</tr>
</tbody>
</table>


1. Types of bacteriological laboratories. Practical Class #1 "Organization of a bacteriological laboratory. Aniline dyes. Simple methods of microorganism staining.


3. Morphology and structure of other representatives of prokaryotes: rickettsiae, chlamydia, mycoplasmas. Practical Class #3 'Morphology and structure of bacteria'.


5. Classification of fungi and protozoa. Practical Class #6 "Growth and
<table>
<thead>
<tr>
<th>Module 2: Special, clinical and ecological microbiology. Special virology.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Vibrio parahaemolyticus.</td>
</tr>
<tr>
<td>5. A group of anaerobic gram-negative rod-shaped bacteria (bacteroids, fusobacteria). Anaerobic cocci of Peptococcus, Peptostreptococcus and Veillonella genera.</td>
</tr>
<tr>
<td>6. Enteropathogenic yersinia (pathogens of pseudotuberculosis and intestinal yersiniosis)</td>
</tr>
<tr>
<td>7. Rickettsia of spotted fever group.</td>
</tr>
</tbody>
</table>
Practical Class #14 “Clinical microbiology.”

Sanitary-virological criteria for assessing water bodies, soil and indoor facilities.  
Practical Class #15 "Sanitary microbiology and virology”.

11. Educational approaches
— methods of scientific and cognitive activity organization and performance (explanatory, illustrative, reproductive);
— methods of scientific and cognitive activity stimulation and motivation (problem teaching, partially searching);
— control and self-control methods of scientific and cognitive activity effectivity.

12. Control approaches
Methods for oral control and self-control:
- Individual questioning;
- Frontal questioning;
- Program questioning.
Methods for written control and self-control:
- Written control test;
- Control test assignments;
- Written module control work (final module testing);
- Program written works.

13. The study success final control form
The form of the final control of learning success after the completion of the third semesters (of the 2nd year of study) is a computer-based exam (test questions). The maximum number of points that can be obtained by a student at the exam is 40 points.

The form of the final control of learning success after the completion of the fourth semesters (of the 3rd year of study) is a computer-based exam (test questions). The maximum number of points that can be obtained by a student at the exam is 40 points.

14. Student mark and point gaining and distribution scheme

<table>
<thead>
<tr>
<th></th>
<th>2nd semester of the 2nd year</th>
<th>1st semester of the 3rd year</th>
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<tbody>
<tr>
<td></td>
<td>MODULE 1</td>
<td>MODULE 2</td>
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<tr>
<td>Number of study hours / credits</td>
<td>165 / 5.5</td>
<td>90 / 3.0</td>
</tr>
<tr>
<td>Quantity of topics / their sequence numbers</td>
<td>11 topics / № 1 - 11</td>
<td>3 topics / № 12 – 14</td>
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<tr>
<td>Forms of semester assessment</td>
<td>Min. 30 points</td>
<td>Max. 60 points</td>
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<tr>
<td>Oral answers and test control at the practical classes</td>
<td>12</td>
<td>24</td>
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<tr>
<td>Assessing the results of studying terminology in the workbook</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Module control test 1 (computer-based testing)</td>
<td>15</td>
<td>30</td>
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</table>
Module control test 2 (computer-based testing)  

| Module control test 2 (computer-based testing) | 15 | 30 |

<table>
<thead>
<tr>
<th></th>
<th>MODULE 1</th>
<th>Final score</th>
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<tr>
<td>Minimum</td>
<td>30</td>
<td>30</td>
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<tr>
<td>Maximum</td>
<td>60</td>
<td>60</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>MODULE 2</th>
<th>Final score</th>
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<tbody>
<tr>
<td>Minimum</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Maximum</td>
<td>60</td>
<td>60</td>
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Single Grades for Students:

<table>
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<tr>
<th>ECTS evaluation</th>
<th>Statistical Index</th>
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<tbody>
<tr>
<td>A</td>
<td>The best 10% of students</td>
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<tr>
<td>B</td>
<td>The next 25% of students</td>
</tr>
<tr>
<td>C</td>
<td>The next 30% of students</td>
</tr>
<tr>
<td>D</td>
<td>The next 25% of students</td>
</tr>
<tr>
<td>E</td>
<td>The last 25% of the students</td>
</tr>
<tr>
<td>FX</td>
<td>Re-exam</td>
</tr>
<tr>
<td>F</td>
<td>Mandatory repeated discipline study</td>
</tr>
</tbody>
</table>

Grading scale: national and ETCS

<table>
<thead>
<tr>
<th>Grading scale</th>
<th>Minimum</th>
<th>Maximum</th>
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<tbody>
<tr>
<td>Excellent</td>
<td>90-100</td>
<td>A</td>
</tr>
<tr>
<td>Good</td>
<td>75-89</td>
<td>B, C</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>60-74</td>
<td>D, E</td>
</tr>
<tr>
<td>Fail with opportunity to re-exam</td>
<td>35-59</td>
<td>FX</td>
</tr>
<tr>
<td>Fail with mandatory repeated discipline study</td>
<td>0-34</td>
<td>F</td>
</tr>
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</table>

15. Methodical supply

Educational content (lecture notes or advanced lecture plans), practice (seminar) lesson plans, laboratory work assignments, self-study work, questions, problems, tasks and cases for intermittent and final knowledge and skill control, complex control tests, after acquired knowledge and skill attestation monitoring in given educational discipline.

PROGRAM CONTENT

Module 1: Morphology and physiology of microorganisms. Infection. Immunity. General and special virology

Content module 1. Introduction to microbiology.

Specific goals:

- To analyze the stages of development of microbiology as a fundamental and applied discipline for medicine and the contribution of individual scientists at each of its stages.
- Describe the main groups of original methods of microbiological research.
To interpret features of structure, morphology, physiology of certain groups of microbes.

Subject 1. Subject and tasks of medical microbiology. The original methods of microbiological research. Principal features of modern medical microbiology. Trends in its development.

Definition of microbiology as a science. Branches of microbiology: general, medical, veterinary, technical, agricultural, oceanic, space. Biotechnology.

Medical microbiology and its sections: bacteriology, virology, protozoology, mycology, and others.

Tasks of medical microbiology in the study of biological properties of pathogenic and non-pathogenic microorganisms, patterns of their interaction with macroorganism, human population and the environment; development and use of methods of microbiological diagnostics, etiotropic therapy and specific prevention of infectious diseases. Methods of microbiological research: microscopy, staining, cultivation, isolation of pure cultures, immunological methods, modeling on animals, virological methods, biotechnological and genetic engineering.

Use of microbes for immunobiological, chemotherapeutic drugs and biotechnological processes.

Relation of medical microbiology with practical activity of a physician. Principles of organization of microbiological service, institutions of microbiological profile.

Microbes as the main object of studying microbiology. Pre-cellular and cellular forms of microbes and infectious agents (prions, viroids, viruses, bacteria, spirochetes, rickettsia, chlamydia, mycoplasma, actinomycetes, fungi, protoza). Microbial features shared with higher animals and plants: self-organization, self-reproduction, self-regulation, ontogenetic and phylogenetic development. Specific features of microbes. Features of microorganisms as living beings: microscopic size, relatively simple organization, high rate of reproduction, exceptional biochemical activity, plasticity and adaptability, widespread distribution in the biosphere, the possibility of pathogenic properties. Non-cellular forms of parasites.

Principal features of modern medical microbiology and trends in its development.

Subject 2. Stages of microbiology development.

The first concept of a contamination.

The invention of a microscope and the discovery of microorganisms (A. Levenguk et al.). The discovery of the first pathogenic microorganisms - favuz and anthrax pathogens.


Medical microbiology in the first half of the twentieth century. Further discoveries of pathogens of infectious diseases. Development of chemotherapeutic direction in microbiology and medicine (P. Ehrlich et al.). The discovery of antibiotics (O. Fleming, etc.).

The discovery of viruses. The formation of virology as an independent science. D.I. Ivanovsky, the founder of virology. Virology in the first half of the twentieth century. The discovery of viruses that infect animals, humans, bacteria (bacteriophages) and cause tumors in animals (oncogenic viruses). Development of methods for laboratory diagnostics of viral infections.

Modern period of development of medical microbiology (second half of XX century - beginning of XXI century). Significance of scientific and technological progress in the field of molecular biology, genetics and genetic engineering, for the further development of theoretical and applied medical microbiology, virology and immunology.
The progress of virology in the second half of the twentieth century is connected with the study of the structure, biochemistry, and the genetics of viruses. The discovery of new viruses - human pathogens (hepatitis viruses, HIV, hemorrhagic fever, Ebola virus, coronavirus (SARS, MERS), etc.). Prions. Development of modern methods of laboratory diagnostics, prevention and therapy of viral infections.


The significance of microbiology in the training of a physician.

**Content module 2. Morphology and structure of prokaryotes and parasitic unicellular eukaryotes.**

**Specific goals:**
- To choose methods of preparation of bacteriological smears.
- Conclude from the microscopy of bacteriological smears using an imersive lens.
- Describe the morphological forms of bacteria.
- Explain the structure of the bacterial cell, constant and non-constant elements.
- Explain the relationship between the chemical composition, structure and function of the structural elements of the bacterial cell.
- To interpret the results of microscopic examination of microorganisms.
- To analyze the morphology and structure of spirochetes, actinomycetes, fungi and protozoa.
- Explain the main differences between Pro- and Eukaryotes.

**Subject 3. Structure of bacteriological laboratory. Dyes and simple methods of microorganism staining. Microscopy.**


**Subject 4. Gram method of microorganism staining.**


**Subject 5. Morphology and structure of bacteria.**


**Subject 6. Morphology and structure of spirochetes, actinomycetes, fungi, protozoa.**


**Content module 3. Physiology of bacteria. Evolution and classification of microorganisms.**

**Specific goals:**

- Describe the most commonly used growth media and their preparation.
- Explain changes in differential diagnostic growth media with bacterial growth.
- Conclude sterilization methods and operating modes of sterilizing equipment.
- Evaluate the methods for isolation of pure cultures of aerobic and anaerobic bacteria.
- To interpret the results of the identification of isolated pure bacterial cultures and to draw conclusions.

**Subject 7. Bacterial metabolism. Growth media for the culturing of microorganisms.**

The chemical composition of the bacterial cell: water, chemical elements and minerals, nucleic acids, proteins, lipids, carbohydrates. Features of the chemical composition of bacteria in comparison with eukaryotic cells.

Features of energy metabolism in bacteria (metabolic rate, variety of metabolic types, metabolic plasticity, excess synthesis of metabolites and energy). Constructive and energy exchange, their interconnection.


Types of biological oxidation of the substrate and methods of obtaining energy in heterohemorganotrophs: oxidative metabolism; rotting - as an aggregation of anaerobic and aerobic splitting of proteins; fermentable metabolism and its products; nitrate breathing. Aerobic, anaerobes, optional anaerobes, microaerophils, captop bacteria.


**Subject 8. Antiseptics and aseptics. Methods and means.**


**Subject 9. Growth and reproduction of microorganisms. Isolation of pure cultures of bacteria.**


**Subject 10. Colonies of microorganisms. Isolation of pure cultures of aerobic bacteria.**

Colonies of microorganisms, peculiarities of their formation, properties. Pigments of microorganisms. Continuous cultivation, its importance in biotechnology (production of enzymes, proteins, antibiotics, etc.). Methods of cultivation of anaerobic bacteria (nutrient medium for obligate anaerobes, anaerostats, etc.).

**Subject 11. Identification of pure cultures of microorganisms.**


The value of the bacteriological (cultural) method in the diagnosis of infectious diseases.

Current ideas about the evolution of the microbial world. Principal differences in the structure and functions between prokaryotes (bacteria), eukaryotes (fungi, protozoa), viruses, viroids, prions. Archebacteria and eubacteria.

History of the development of ideas about the taxonomy of microorganisms. Phylogenetic (natural) taxonomy and use of the genetic system approach.

Classification of prokaryotes, taxonomic groups. Species and its definitions in microbiology. Intraspecies categories: subspecies, variants. Taxonomic value of 16 S ribosomal RNA.

Concept of population, culture, strain and clone in microorganisms. Binary nomenclature of bacteria. Classification of fungi and protozoa.

Content module 4. Genetics of microorganisms.
Specific goals:

- Explain the mechanism of operation of the operon.
- Explain the mechanism of various forms of genotype variability (mutations and recombinations).
- Conclude the presence of bacterial colonies of S- and R-forms.
- Know and be able to explain the mechanism of genetic methods of diagnostics and identification of bacteria.
- Conclude that the studied microorganism belongs to pro-eukaryotes.
- Explain the relationship between genetic structures and virulence factors of bacteria.

Subject 13. Genetics of microorganisms.

Definition of genetics of microorganisms as a science. Its importance in the theory and practice of medicine.


Bacteria plasmids, their properties. Conjugative and non-conjugative, integrative and autonomous plasmids. Classification of plasmids by functional activity: F, R, Co1, H1u, Ent and other plasmids. Integrons, superintegrons.

Transposons, insertion sequences. General characteristics and functions of mobile genetic elements.

The concept of the gene pool, genotype and phenotype. Types of variability in bacteria. Modification variability, its mechanisms and forms of manifestation in bacteria.


Microbiological foundations of genetic engineering and biotechnology. Use of enzymes (restriction enzymes, ligases, polymerases, revertases) in genetic engineering studies. Vectors used to transport genetic material. Features of genes expression in prokaryotic and eukaryotic
cells. Practical use of the results of genetic engineering studies in medicine, biology and the agriculture.

Genetic methods in the diagnosis of infectious diseases and in the identification of bacteria: DNA sequences, polymerase chain reaction, nucleic acid hybridization, determination of nucleic acid fragments length, and others. Biochips, application in diagnostics.

**Content module 5. Antimicrobial chemotherapy and antibiotic therapy.**

**Specific goals:**
- To analyze the phenomenon of microbial antagonism.
- Explain the mechanism of action of antibiotics on a microbial cell.
- Evaluate methods for determining the sensitivity of microorganisms to antibiotics.
- Conclude the sensitivity of microorganisms to antibiotics.
- To interpret mechanisms of resistance of microorganisms to antibiotics.
- Explain the mechanisms of antibiotic therapy-caused complications.

**Subject 14. Chemotherapeutic drugs. Antibiotics.**


Natural and acquired resistance to antibiotics. Genetic and biochemical mechanisms of antibiotic resistance. The role of plasmids and transposons in the formation of drug resistance of bacteria. Ways of preventing the formation of resistance of bacteria to antibiotics. Principles of rational antibiotic therapy. Intercellular communication in bacteria (signal systems, "quorum sensing") and the prospects for creating new generation of antimicrobial drugs on its basis.

The value of the discovery of antibiotics (XX century) for etiotropic therapy of bacterial, spirochetous, fungal, protozoal infections.

**Content module 6. Infection.**

**Specific goals:**
- To interpret the concept of „infectious process”.
- To analyse forms of infectious process, their characteristic and the factors, which are necessary for development of an infectious process.
- To evaluate the factors of bacterial pathogenicity.
- To specify the concept of „pathogenicity”, „virulence”.
- To analyse the mechanisms of the infectious process development (pathogenesis).
Subject 15. Infectious process, its types, necessary factors for initiation and development of an infectious process.

Definition of the terms “infection”, “infectious process”, “infectious diseases”. The history of the concept about the nature of infectious process. The factors, which are necessary for development of an infectious process.

The role of microorganisms in an infectious process. Pathogenicity of the microorganisms, pathogenicity assays. Pathogenicity as a consequence of the parasitism evolution. Obligate pathogens, opportunistic pathogens, non-pathogenic microorganisms.


Stages of infectious process. Minimal infective dose that are required to produce the infectious disease. Routes of invasion by pathogens in organism. Adhesion of microorganisms, colonization, aggregation, biofilm formation, invasion. The spreading of microbes and their toxins in an organism: bacteremia, toxemia, septicemia and its consequences. Microbial carriage. Asymptomatic infection. The dynamics of development of infectious diseases - periods of infectious diseases: incubation period, prodromal period, period of illness, recovery period.

Types of infection: exogenous and endogenous infection; localized and generalized infection; monoinfection and mixed infection; reinfection, superinfection, relapse (recidivation); acute, chronic infection, persistence of microorganisms. The concept of wound infections, respiratory infections, intestinal infections, sexually transmitted infections, skin infections; anthropo-, zoo-, anthropozoo- and sapronoses. The mechanisms of transmission of causative agents of infectious diseases: inhalation (droplet spread), ingestion, sexually transmitted, transmissible, trans-placental, directly transmitted, inoculation. The concept of pathogenesis of infectious disease.

Bioassay technique. The use of bioassay technique to study aetiology, pathogenesis, immunogenesis, diagnostic, therapy and prevention of infectious diseases. Laboratory animals, genetically engineered line of animals (inbred lines).

Content module 7. Immune system of an organism. Reactions of nonspecific defence from microorganisms.

Specific goals:

➢ To analyse the historical periods of immunology science and contribution of scientists in the distinct periods.
➢ To interpret the term „immune system of an organism”.
➢ To explain the role and mechanisms of human nonspecific anti-infectious defence.

Subject 16. The main periods of immunology science development.

Empirical phase, including of Edward Jenner's creation of the first smallpox vaccine. Louis Pasteur – attenuating microbes for vaccines. The development of the rabies and anthrax vaccines.

Theory of the cellular (Ilya Ilyich Mechnikov) and humoral (Paul Ehrlich) immunity. Modern trends in immunology:
The contribution of the scientist from our country and foreign scientists in advancement of immunology. The Nobel Prizes in immunology. The main branches of immunology: immunology of infectious diseases and non-infectious immunology, clinical immunology, transplant immunology, ecological immunology; immune genetic, immunopathology, immuno- oncology, allergology, cytoimmunology, immuno-hematology etc. The role of immunology in the advancement of medicine and biology, its connection with other sciences. Immunological methods of study.

Subject 17. The organs of the immune system. Factors of nonspecific defence from microorganisms.

Immunity as type of defence from substances, which is genetically foreign to the host, that is realized by specialized immune system.

Development of the immune system.
Factors of non-specific defence of the organism.
Barrier and antimicrobial properties of skin and mucosa. Resident microflora. Reactivity of the cells and tissues. Physicochemical factors, function of the excretory organs and system.


The system of killer cells of human organism: natural killer cells, large granular lymphocytes (LGL), K cells, LAC – cells (lymphokine activated killer cells), their role in immune recognition of genetically (pathologically) changed cells in human organism.

Macrophages (motile and tissue-resident), granulocytes – neutrophils, eosinophils, basophils, (motile and tissue-resident).

Humoral factors of nonspecific immune defence: the complement system, lysines, interferons, leukines, virus inhibitors, lysozyme, properdin, fibronectin etc.

The main components of the complement system. The role of complement in chemotaxis, opsonization and lysis of microbial cells, development of allergy and immunopathological processes. Methods for qualitative and quantitative detection of the complement activation. Classical and alternative pathways of complement activation.

Interferons. Classification of interferons, inducers, the mechanism of the production, biological functions of interferons (antiviral, anticancer, immunomodulatory, radioprotective). Recombinant interferons.

The structure of the immune system.

Central organs of the immune system: the thymus gland, bone marrow. Peripheral organs of the immune system: spleen, lymph nodes, lymphoid follicles of the mucosa-associated lymphoid tissue. Immunocompetent cells. T lymphocytes, their ontogenesis: Th0, Th1, Th2, their comparative characteristics. The cell surface markers and receptors of those cells: CD4⁺ - lymphocytes (helper cells), CD8⁺- lymphocytes (cytotoxic, effector cells), their function. B lymphocytes, their ontogenesis. B lymphocytes subpopulations. Their cell surface markers and receptors. Immunocompetent cell cooperation in immune response. The concept of immunomodulators. Immunostimulants and immunosuppressants.


Specific goals:

➢ To explain the role of antigens as inductors of the immune response.
➢ To describe of antigen structure, including the antigens of microorganisms.
➢ To explain the role of antibodies in the immune response.
➢ To describe the structure of antibodies (immunoglobulins of different classes).
➢ To analyze the mechanisms of interaction between antibodies and antigens.
➢ To interpret the participation of the immune system cells in the immune response and phases of the immune response.

**Subject 18. Characteristic of antigens.**

Antigens as inductors of the immune response.


**Subject 19. Antibodies as a product of humoral immune response.**

Structure and functions of antibodies (immunoglobulins).


**Content module 9. Immune reactions. Immunopathology.**

**Specific goals:**
➢ To analyze forms and types of immune reactions.
➢ To interpret phases of immune response development.
➢ To make a summary about the use of microbial antigens in medical practice.
➢ To make a summary about the use of antibodies in medical practice.

**Subject 20. Reactions of immune response. The principles of the use of antibodies as therapeutic and prophylactic tools and for diagnostic assays.**


The cellular immune response and its phases: antigen recognition, antigen processing and presentation to T helper cells, proliferation and differentiation of effector T cells (helper cells, suppressor cells, delayed-type hypersensitivity effector cells, memory cells). Cytokines and their role in generation of cell-mediated immune reactions.

Characteristic of the immune response development: antibody production, immediate and delayed hypersensitivity, immunological memory, immunological tolerance, network of idiootype/anti-idiootype interactions.


Serological diagnosis of infectious diseases by detection of antibodies in blood serum of patient, which are specific to causative agent of infection. Diagnosticums, obtaining and practical using for serological diagnosis of infectious diseases (detection of antibodies in in blood serum of patient). The concept of “antibody titer”, “diagnostic titer”, “diagnostic antibody titer increase” “paired serum”. Principle of differentiation of acute and past infections based on the results of serological reactions. Criteria of serological diagnosis: detection of antibodies specific to causative agent of infection in diagnostic titer, detection of diagnostic antibody titer increase, detection of IgM antibodies specific to causative agent of infection.

Monoclonal antibodies, their application.


Subject 21. The principle of application of microbial antigens as prophylactic and diagnostic preparations.


Subject 22. Immunopathology. Study of immune reactivity.


Complex study of immune reactivity by indexes of nonspecific immune defence factors, and by state of T and B systems. The role of study of immune reactivity in diagnosis of infectious disease and immune system pathology.

Immunodeficiency disorders. Classification of immunodeficiency disorders as primary and secondary, congenital and acquired.

Autoimmune processes. Autoimmune diseases associated with failure of histohematogenous barriers of sequestered organs, induced by cross-reacting antigens. Disruption of immune tolerance as a consequence of damage of immune system functions during lymphoproliferative disorders and defects of the immune system. Principles and perspectives of autoimmune disorders treatment.


Module 1. General and special virology.

Content module 10. General Virology.

Specific goals:

➢ To interpret morphology and ultrastructure of viruses.
➢ To analyze the features of viral interaction with living systems.
➢ Evaluate the results of virus propagation in living systems.
➢ To analyze the methods of viral cultivation under laboratory conditions.
➢ To characterize antiviral chemotherapeutic drugs and their mechanism of action.

Subject 22. Morphology and ultrastructure of viruses. Cultivation of viruses in chicken embryos and laboratory animals.


The chemical composition of viruses: nucleic acids, proteins, lipids, polysaccharides. Their features and functions. Viral enzymes, their role, classification.

Replication of virus within host cell. The main stages of the interaction between virus and host cell during productive infection. Integrative and abortive types of interaction between viruses and host cells. Persistence of the virus in cells. Viral interference, defective interfering particles. Satellite viruses. Techniques of virus cultivation in chicken embryos, in laboratory animals.

Indication of viral reproduction by hemagglutination assay (HA) and hemadsorption. Antiviral chemotherapeutic agents, classification: inhibitors of adsorption, penetration and deproteinization of viruses; reverse transcriptase inhibitors, DNA polymerase inhibitors of DNA- viruses; polymerase inhibitors of RNA and DNA- viruses; inhibitors of viral m-RNA. Interferons and inductors of their synthesis, mechanism of antiviral action.

Indication of viral reproduction.

Cultivating of viruses using cell culture technique. Classification and characteristics of cell cultures used in virology. Methods of detection (indication) of viral reproduction by Cytopathic effect, plaque formation under agar and bentonite coating, viral inclusion bodies. Methods of quantitative determination (titration) of viruses. Genetic methods for the detection of viruses and their nucleic acids.

Subject 24. Serologic reactions used in virology.


Subject 25. Genetics of viruses. Bacteriophages, practical application.


Practical use of bacteriophages in microbiology and medicine in order to identify bacteria, prevent and treat infectious diseases, and to assess the microbial contamination of environmental objects.

Content module 11. Special Virology.

Specific goals:

➢ To analyze biological properties of human pathogenic viruses.
➢ To explain the role of viruses in human pathology.
➢ To interpret the methods of viral infections diagnosis, to draw conclusions based on research results.
➢ To analyze drugs used for specific prevention of viral diseases.

Subject 26. Orthomyxoviruses.


**Subject 27. Paramyxoviruses.**


**Subject 28. Picornaviruses.**


The role of enteroviruses in human pathology. Pathogenesis of poliomyelitis and other enterovirus infections. Immunity. Specific prevention and therapy. The problem of polio eradication around the world.

Laboratory diagnosis of enterovirus infections.

Rhinoviruses (Rinovirus). General characteristics. Classification. Pathogenesis of rhinovirus infection. Laboratory diagnostics.


The genus Cardiovirus (Cardiovirus). General characteristics. The role in human pathology.

**Subject 29. Retroviruses. HIV.**


**Subject 30. Other RNA viruses.**

Reoviruses (family Reoviridae) General characteristics. Classification. The role of human pathology. The genus Rotavirus. Classification, properties. The role in human pathology. Laboratory diagnostics.


Coronaviruses (the family Coronaviridae). General characteristics. Severe acute respiratory syndrome-related coronavirus (SARS-CoV,). Middle Eastern Respiratory Syndrome Virus (MERS). The role of human pathology. Laboratory diagnostics.


Emerging and re-emerging infectious disease.

Subject 31. Poxviruses, papawaviruses, paroviruses.


Adeno-associated viruses, properties, use in genetic engineering.

Subject 32. Herpesviruses.


Subject 33. Adenoviruses.

Subject 34. Viral hepatitis.

Hepatitis A virus (family of Picornaviridae), peculiarities. Approaches to specific prevention of hepatitis A. Laboratory diagnosis of hepatitis A.
Other pathogens of hepatitis: C, D, E, G, TTV, SENV, their taxonomy, properties, role in human pathology, methods of laboratory diagnosis.

Subject 35. Ecological group of arboviruses.

Ecological community of arboviruses.

Subject 36. Oncogenic viruses.

Oncogenic DNA viruses: papillomaviruses, poliomaviruses, herpesviruses, and others. General characteristics, participation in human carcinogenesis.
Oncogenic RNA viruses from the family of Retroviridae. Morphology, classification. The role in human carcinogenesis. Oncogenic viruses of other taxonomic groups (representatives of the families Adenoviridae, Poxviridae, Hepadnaviridae, etc.). General characteristics. Endogenous retroviruses.

Subject 37. Prions.

Prions. Properties. Prion diseases of animals (scrapie, spongiform encephalopathy of cows) and humans (kuru, Jakob-Creutzfeldt disease, etc.). Physical and chemical properties. The mechanism of replication in vivo.

Module 2: Special, clinical and ecological microbiology.

Content module 12. Pathogenic prokaryotes and eukariotes.
Specific goals:
➢ To interpret the biological properties of pathogens of infectious diseases.
➢ Explain the pathogenetic patterns of infectious processes caused by pathogenic prokaryotes and eukaryotes.
➢ To define methods of microbiological diagnostics, etiotropic therapy and prevention of infections caused by pathogenic prokaryotes and eukaryotes.

Subject 1. Staphylococci and streptococci (Micrococcaceae and Streptococcaceae families).

Evolution of the coci group of bacteria, their general characteristics.
Etiological and pathogenetic role of group A streptococci in respiratory infections, erysipelas, tonsillitis, scarlet fever, acute glomerulonephritis, rheumatism, sepsis, and others.
Oral streptococci, their role in caries and other dental diseases.

Subject 2. Meningococci and gonococci (Neisseriaceae family).
Meningococci (Neisseria meningitidis). Biological properties, classification. Pathogenesis and microbiological diagnostics of meningococcal diseases and bacteria-carrying state. Differentiation of meningococci and gram-negative diplococci of nasopharynx. Prevention of meningococcal infection.

Escherichia genus, their main properties. Physiological role and sanitary significance. Diarrheic escherichia. Classification by antigenic structure and division into categories depending on virulence factors, serological markers and clinical and epidemiological features. Parenteral escherichiosis. Microbiological diagnostics of Escherichia coli.

Subject 4. Salmonella.

Subject 5. Salmonella - the agents of gastroenterocolitis.

**Subject 6. Shigella.**


**Subject 7. Other pathogenic enterobacteria.**


Proteus, Morganella and Providencia genera. The value of individual species in the etiology of acute intestinal infections, purulent inflammatory processes, mixed infections, hospital infections and food toxicoinfection. Microbiological diagnostics of diseases.


**Subject 8. Vibrio (Vibrionaceae family)**


Other vibrios as a cause of gastroenteritis, wound infection, inflammatory diseases of the internal organs.

**Subject 9. Corynebacteria (Corynebacteriaceae family).**


**Subject 10. Mycobacteria (Mycobacteriaceae family)**

Mycobacteriosis pathogens. Classification, properties. The role in human pathology.
Mycobacteriosis as a manifestation of HIV - infection.

**Subject 11. Anaerobic infection agents (Bacillaceae family).**


Clostridium difficile, a role in human pathology.

**Subject 12. Zoonotic infection agents.**
The causative agent of tularemia (Francisella tularensis) Biological properties. Pathogenesis, immunity, methods of microbiological diagnostics. Specific prevention of tularemia.


**Subject 13. Rickettsia, Chlamydia, Mycoplasma.**
Mycoplasma (Mycoplasmataceae family). General characteristics of the Molliculate class. Classification. Biological properties. The role in human pathology. Mycoplasmas - pathogens of pneumonia, acute respiratory diseases, urethritis, endocarditis, pathologies of

**Subject 14. Spirochetes.**

General characteristics. Classification.

**Subject 15. Pathogenic undulate forms of bacteria.**

Spirillum genus. The causative agent of fever obtained from the rat bite. Microbiological diagnostics of the disease.
Campylobacter genus. Classification. Campylobacter, a causative agent of purulent-inflammatory and acute intestinal diseases. Biological properties, microbiological diagnostics.

**Subject 16. Anaerobic nonclostridial bacteria.**

Fusobacterium. Propionibacteria (Propionibacterium).

**Subject 17. Pertussis causative agent.**


**Subject 18. Gram-negative nonfermenting bacteria.**

Other gram-negative nonfermenting bacteria: acinetobacteria, moraxels.

**Subject 19. Other pathogenic bacteria.**


Subject 20. Pathogenic fungi and actinomycetes.
Pathogens of deep mycoses: blastomycosis, histoplasmosis, cryptococcosis. Properties Pathogenicity for a person. Microbiological diagnostics.

Subject 21. Pathogenic protozoa.
Free-living amoeba (acanthamoeba, hartmanella, negleria). Role in pathology.

Content module 13. Fundamentals of Clinical and Environmental Microbiology
Specific goals:
➢ To interpret biological properties of pathogenic and opportunistic microorganisms and patterns of their interaction with the human organism and the environment.
➢ To determine the methods of microbiological, virological diagnostics, etiotropic therapy and prevention of opportunistic and hospital infections.

Subject 22. General characteristics of clinical microbiology.

Subject 23. Opportunistic infections.

Subject 24. Healthcare acquired infections (clinical, hospital, nosocomial).
Definition. Classification. Conditions contributing to their occurrence and widespread distribution in hospitals. The microorganisms that most often cause hospital infection (staphylococci, streptococci, proteus, escherichia, serratia, salmonella, pseudomonads, escherichia, vibrios, citrobacter, branhamella, moraxella, listeria, mycobacteria, bacteroids, fusobacteria, peptosterectococci, clostridia, mycoplasma, Candida genus fungi etc.). The most common pathology: wound infections, purulent-inflammatory processes of the skin, subcutaneous adipose tissue, respiratory organs, central nervous system, gastrointestinal tract, genitourinary system, eyes, ears, sepsis, septicopimeemia.
Etiology, pathogenesis, clinical forms of a hospital infection caused by obligatory pathogenic microbes (nosocomial tocospecific salmonellosis, hospital colienteritis, hepatitis B, adenovirus conjunctivitis, local and generalized forms of herpetic and cytomegalovirus infection, chlamydial and mycoplasma urethritis, dermatomycosis, etc.). Conditions for a successful diagnosis of intra-hospital infections. Criteria of etiological role of microorganisms isolated in bacteriological diagnostics of intra-hospital infections. Prevention of hospital infections.

Subject 25. Ecological microbiology.
Definition. Scientific and social prerequisites for the formation of ecological microbiology. Population, biotope, microbiocenosis. The main types of interspecies relationships: neutralism, symbiosis (commensalism, parasitism, mutaulism), competition. Dynamism of environmental relationships.
Ecological systems of microorganisms. Free-living and parasitic microbes. Soil, water and air microflora - atmospheric and that of enclosed premises (medical institutions, dwellings, etc.).

Microbiological aspects of environmental protection. Protection of groups of microorganisms that take part in the substances and energy cycling from the damaging effects of man-made factors. Biological and technogenic pollution of the environment and the role of microbes in biodegradation. Microbial degradation of national and household materials, medicines. Problems of protection of the biosphere from artificial mutants and "space" microbes.


Ethology of microbes.


Effects of chemical and physical environmental factors on microorganisms. Influence of temperature, environmental pH, drying, radiation, ultrasound, atmospheric and osmotic pressure, chemical substances of different classes. Mechanism of the harming effect of these factors.

Content module 14. Sanitary microbiology and virology.

Specific goals:

➢ To interpret the concept of "sanitary-indicative microorganisms" and their role as an indicator in assessing the degree of contamination by pathogenic microorganisms of the environmental objects: water, soil and air.
➢ To analyze the qualitative and quantitative composition of microbes in water, soil, air, and draw conclusions about their epidemic safety.
➢ To interpret sanitary-virological and bacteriological criteria for assessing water bodies, soil and air in enclosed spaces.


The importance of sanitary microbiology in a physician’s work. Tasks and methods of conducting microbiological research. Direct methods for the determination of pathogenic microorganisms in environmental objects and indirect methods of sanitary-microbiological research. Microbial count.

Sanitary-indicative microorganisms (SIM) of soil, water and air. Terms and conditions for the survival of pathogenic microbes in the environment.

Soil sanitary microbiology. Soil sanitary microbiology in connection with infection prevention. Pathogenic microorganisms that are identified in the soil. Microbial soil inhabitants. Microbes that get into the soil with human and animal feces. Methods of soil sanitary-microbiological research. Factors that affect the qualitative and quantitative composition of microbial soils. Microbial count, coli titer, titer-perfringens of soil.

Air sanitary microbiology. The role of air in the transmission of infectious diseases. Methods of determining air microbial count. Factors that affect the microbial composition. Methods of sanitary-bacteriological study of air (sedimentation and aspiration). Estimation of the sanitary condition of the enclosed premises for general microbial contamination, the presence of SPM (staphylococci, B - and V - hemolytic streptococci), which are indicators of air contamination with the nasopharynx microflora.

Subject 27. Sanitary virology.

Subject, task, importance of sanitary virology in the activities of the physician. The role of water, soil, air in the transmission of pathogens of viral infections. Viruses that are most often detected in environmental objects.


Methods of detecting pathogenic viruses in the soil. Investigation of the soil for the presence of enteroviruses.

Role of the air environment in the spread of pathogens of respiratory viral infections. Methods for air sampling and respiratory viruses indicating.

LIST OF QUESTIONS TO THE FINAL MODULE ASSESSMENT OF THE RELEVANT MODULES AND THE DISCIPLINE IN GENERAL


Content module 1. Introduction to microbiology.

1. Definition of microbiology as a science. Fields in microbiology. Subject and objectives of medical microbiology. Main features and trends of modern microbiology development.


1. The main differences between prokaryotes and eukaryotes. Forms of bacteria with a defect in the synthesis of cell walls, protoplasts, spheroplasts. L-form bacteria.


4. Classification and morphology of fungi.


6. Principles of organization, equipment and operation of bacteriological, serological and virological laboratories.
7. Bacterioscopic method of investigation. Stages

Content module 3. Physiology of microorganisms (prokaryotes). Evolution and classification of microorganisms.

2. Respiration in microorganisms. Aerobic and anaerobic types of respiration. Enzymes and cell structures involved in the process of respiration. Methods of culturing anaerobic bacteria.
4. Bacterial growth and reproduction. The mechanism of cell division, the phases of bacteria culturing under stationary conditions.

Content module 4. Genetics of microorganisms.


Content module 5. Microbiological fundamentals of antimicrobial chemotherapy.

2. The phenomenon of microbial antagonism. The role of native microbiologists in the development of the theory of microbial antagonism. Antibiotics, characterization, principles of obtaining, units of measurement. Classification by mechanism of action on microorganisms.

Content module 6. Infection.

1. Infection. The factors, which are necessary for development of an infectious process. The role of microorganisms in development of an infectious process. Pathogenicity, virulence, the units of virulence of bacteria and the methods of their determination. The factors of virulence of microorganisms, their characteristic.
2. Toxins of microorganisms (exotoxins, endotoxins). Features and chemical structure, isolation, measurement of potency of exotoxins. The role in pathogenesis and immunogenesis of infection diseases.

Content module 7. Immune system of an organism. Reactions of nonspecific defence from microorganisms.
1. Study of immunity. The periods of immunology development. Types of immunity and forms of immunity.
3. The immune system of an organism, organs of the immune system. The role of the thymus gland in the immune response. The cells of the immune system, their types, interactions of T-lymphocytes, B-lymphocytes and macrophages. Their role in the cellular and humoral immunity.
5. Immediate hypersensitivity and delayed hypersensitivity, their mechanisms, differences. Practical importance.
6. The three-cell cooperation scheme of induction of the immune response. The role of different cells of the immune system, their interaction. Interleukins.

2. Antibodies, their properties. The location of their production, dynamics of antibody production.
4. Antitoxins, their properties, mechanism of action. The principles of obtaining of antitoxic immune sera. The units of their activity, practical use.
5. Serological reactions, their characteristic, main types, practical use. Agglutination reaction, its mechanism, types. Practical use.
7. Serological reactions. Lysis reactions. The complement-fixation reaction, practical use.
8. Serological reactions with labeled antibody or labeled antigens. Practical use of immunofluorescence reaction (RIF), enzyme immunoassay and radioimmune assay.

1. The forms and types of immune response. Humoral immune response and its phases.
2. Primary and secondary immune response. Immune cell cooperation in immune response.
5. Monoclonal antibodies, their production and the use in medical practice.
7. Live vaccines, methods of their obtaining. Regulation, practical use of live vaccines, determination of their effectiveness.
8. Vaccines. History of vaccine development. Classification of vaccines. Subunit (chemical) vaccines, synthetic vaccines, recombinant vaccines, anti-idiotypic vaccines, liposomal and capsular vaccines, mucosal vaccines, ribosomal and RNA vaccines, vaccines from transgenic plants.
10. Anatoxins, their obtaining, purification, activity units, practical use, value.
11. Corpuscular vaccines obtained from killed microorganisms. The main principles of their manufacture, regulation, determination of their effectiveness.

Content modul 10. General virology.

5. Modern views on the nature and origin of viruses. Place of viruses in the live system.
7. Methods of cultivation of viruses and their evaluation.
8. Reactions of viral hemagglutination and hemadsorption. The mechanism, practical importance, use and diagnostic value.
9. Serological tests that are used in virology. Reaction of virus neutralization, mechanism, principles of use, diagnostic value.
10. Hemagglutination inhibition test, its mechanism, principles of use, diagnostic value.
12. Reactions with labeled antibodies and antigens in virology. Immunofluorescence reaction (IFR).
14. Types of interaction between viruses and cells. Characteristics of productive interaction, phases.
19. Viral vaccines, classification, principles receiving, the requirements for them, control, evaluation of effectiveness.
Content modul 10. Special virology.

4. Pathogenesis and immunity during influenza. The role of specific and nonspecific mechanisms of immunity to influenza.
5. The problem of specific prophylaxis and therapy of influenza. Preparation their evaluation.
6. Paramyxoviridae family, the general characteristics. Parainfluenza viruses, their biological properties. Role in the development of human pathology. Laboratory diagnosis of parainfluenza infections.
12. Enterovirus genus, general characteristics, classification. Laboratory diagnosis of infections caused by enteroviruses.
15. General characteristics of the arbovirus ecological group. Tick-borne and japanese encephalitis viruses. History of discovery and study of these viruses. Biological properties, methods of laboratory diagnosis, specific prophylaxis.
27. Emerging and re-emerging infectious diseases.

**MODULE 2: SPECIAL, CLINICAL AND ECOLOGICAL MICROBIOLOGY.**

**Content module 13. Pathogenic prokaryotes and eukaryotes**

1. Evolution of cocci, their general characteristics. Staphylococci, biological properties, classification, practical significance.
2. The role of staphylococci in the development of human pathology, the pathogenesis of staphylococci – caused processes. Characteristics of pathogenicity toxins and enzymes. The role in the occurrence of hospital infection.
5. Streptococcus pneumoniae, biological properties. Pathogenicity for humans and animals. Microbiological diagnostics of pneumococcal diseases.
10. Pathogenetic fundamentals of microbiological diagnostics of typhoid and paratyphoids A and B. Methods of microbiological diagnostics, their evaluation.

17. The causative agent of tularemia, biological properties. Pathogenesis, immunity, methods of microbiological diagnostics and specific prevention of tularemia.


20. Bordetella, their properties. Pertussis causative agent, morphological, cultural, antigenic properties. Microbiological diagnostics and specific prevention of pertussis.


22. General comparative characteristics of anaerobic bacteria, their importance in the development of human pathology. Features of microbiological diagnostics of diseases caused by anaerobes. Anaerobic non-clostridial bacteria (bacteroids, etc.), their biological properties.

23. Clostridium tetani, properties. Toxin formation. Pathogenesis of tetanus in humans. Microbiological diagnostics, specific prophylaxis and therapy, their theoretical substantiation and assessment.


34. Leptospira, their characterization, classification. Pathogenesis, immunity and microbiological diagnosis of leptospirosis. Specific prevention and therapy.

36. Rickettsia, biological properties. Classification. Rickettsia - pathogens of human
diseases.
Q-fever causative agent. Pathogenesis of the disease, laboratory diagnosis, specific prevention.
37. Typhus causing pathogens, properties. Pathogenesis of the disease, evaluation of
methods. Specific prevention, evaluation of drugs. Laboratory diagnostics.
38. Mycoplasma, classification. Biological properties, methods of cultivation. Role in the
development of human pathology. Microbiological diagnostics of mycoplasmosis.
39. Chlamydia, classification, biological properties. Methods of cultivation. Role in the
development of human pathology. Microbiological diagnostics of chlamydia.
40. Malaria plasmodia, their characteristics. Pathogenesis of malaria. Microbiological
diagnostics. Specific prevention and therapy.
Microbiological diagnostics. Specific therapy.
42. Pathogenic protozoa, biological properties. Classification. Role in the development of
human pathology. Leishmania, properties, pathogenesis of diseases. Microbiological diagnosis of
leishmaniasis.
43. Pathogenic spirilli. The causative agent of rat bit caused fever. Microbiological
diagnostics of the disease.
44. Campylobacter - pathogens of acute intestinal diseases. Biological properties,
microbiological diagnostics.
45. Helicobacter pilori - a causative agent of human gastroduodenal diseases. Discovery,
biological properties, pathogenesis. Methods of microbiological diagnostics. Modern methods of
helicobacter infection treatment.
46. Modern methods of laboratory diagnostics of infectious diseases.

**Content module 14. Fundamentals of Clinical and Environmental Microbiology.**

1. Opportunistic pathogens, biological properties, etiological role in the development of
opportunistic infections. Characteristics of diseases caused by opportunistic pathogenic
microorganisms.
2. Hospital infection, conditions of its occurrence. Properties of hospital ecovars of
microorganisms. Microbiological diagnostics of purulent-inflammatory, burn infections and
wound infections caused by hospital strains.
role of opportunistic pathogens isolated from the pathological foci.

**Content module 15. Sanitary microbiology and virology.**

1. Ecology of microorganisms. Propagation of microbes in nature. The value of S.M.
Vinogradsky works.
2. Normal microflora of the human body, its role in physiological processes in human
pathology. Age-related features of normal microflora of the nose, skin, oral cavity, genitals,
3. Probiotics and eubiotics, their characteristics, mechanism of action.
4. Sanitary microbiology, subject, task. The importance of sanitary microbiology in the
activities of a physician.
5. Sanitary-indicative microorganisms, requirements, their importance for the
characterization of the objects of the environment.
Sanitary and bacteriological control of drinking water quality. Requirements of the State
Standard for drinking water.
microorganisms in water. The role of water in the transmission of infectious diseases.


10. Sanitary-indicative microorganisms used in water quality assessment.


12. Soil microflora. The role of soil in the transmission of infectious diseases. Factors that affect the survival of pathogenic microorganisms in the soil.

13. Sanitary-indicative microorganisms that are used in the assessment of soil contamination. Methods of soil sanitary-microbiological study.

14. Air microflora, its characteristics. The role of air in the transmission of infectious diseases.

15. Microbial count and sanitary-indicative microorganisms of enclosed premises air, determination methods, their evaluation.


17. Food poisoning of microbial etiology. Classification of food poisonings and pathogens that cause them.


19. Sanitary and bacteriological study of food products for botulinum toxin detection.


21. Sanitary and bacteriological study of food products for pathogenic staphylococci detection.

22. Sanitary virology, subject, tasks, importance of sanitary virology in the activities of the physician.

23. The role of water, soil, air in the transmission of pathogens of viral infections. Viruses that are most commonly detected in environmental objects.

24. Methods of pathogenic microorganisms detection in the soil. Soil study for the presence of enteroviruses.


26. The role of the air environment in the spread of pathogens of respiratory viral infections. Methods of sampling air and indicating respiratory viruses

LIST OF PRACTICAL CLASSES AND TASKS FOR MODULE ASSESSMENT

MODULE 1: MORPHOLOGY AND PHYSIOLOGY OF MICROORGANISMS. INFECTION. IMMUNITY. GENERAL AND SPECIALIZED VIROLOGY.

1. Perform microscopy of the smear using an immersive lens, conclude on the morphological properties of the studied microorganisms.

2. Prepare a bacterial smear, stain according to Gram method, perform a microscopy using an immersion lens, draw a conclusion on the purity of the culture of microorganisms studied.

3. Describe the properties of colonies of microorganisms grown on Endo medium. Find colonies characteristic of E. coli. Explain the essence of the use of differential diagnostic media containing carbohydrates.

4. Substantiate the basics of vaccine prophylaxis. Pick up 2-3 live vaccines, explain the principles of their manufacture and use.
5. Substantiate the basics of vaccine prophylaxis. Pick 2-3 non-live vaccines, explain the principles of their manufacture and use.
6. Explain the basics of antitoxic immunity. Pick up medications for obtaining active antitoxic immunity.
7. Explain the basics of antitoxic immunity. Pick up medications for obtaining passive antitoxic immunity.
8. Select the drugs used for specific prevention and therapy of diphtheria, explain the aspects of their use.
9. Explain the basics of the immunoassay method of study. Record the IFA delivered for serological diagnosis of HIV infection.
10. Explain the basics of serological identification of microorganisms. Pick up drugs that are used for this purpose. Principles of their receipt.
11. Explain the basics of serological diagnostics of infectious diseases. Choose the preparations used for this purpose, their reception.
12. Explain the basics of the virological diagnosis of influenza. Record the hemagglutination assay (HA), set for virus detection. Make a conclusion about the presence and titre of the virus.
13. Explain the basics of the virological diagnosis of influenza. Record the hemagglutination inhibition (HAI) for serological identification of the selected virus. Conclude the type of virus.
15. Explain the basics of the virological diagnostics of poliomyelitis. Establish the presence of a virus in cell cultures infected with a patient's material, a cytopathogenic effect (CPE) and a phenomenon of plaque formation. Conclude.
16. Explain the basics of the virological diagnostics of poliomyelitis. Record the reaction of the virus neutralization (RN), set for the purpose of serological identification of the virus isolated from the patient. Conclude the type of virus.
17. Explain the basics of the virological diagnosis of viral diseases. Perform microscopy of a smear made of brain tissue to detect the Babes-Negri bodies.

**MODULE 2: SPECIAL, CLINICAL AND ECOLOGICAL MICROBIOLOGY.**

1. Perform bacterioscopic diagnostics of acute gonorrhea. Perform a microscopy of the stained smear from the patient's material and draw a conclusion.
2. Carry out a bacterioscopic diagnostics of tuberculosis. Perform a microscopy of the specifically stained smear from the patient material. Conclude.
3. Carry out a bacterioscopic diagnostics of diphtheria. Perform a microscopy of the specifically stained smear from the patient material. Conclude.
4. Serologic diagnostics of typhoid fever and paratyphoid. Conduct an account of indirect hemagglutination reaction (IHA), conclude.
5. To carry out serological diagnostics of abdominal typhoid and paratyphoid. Conduct an account of Vidal's reaction, conclude.
6. Serologic diagnostics of syphilis. Conduct the recording of the Wasserman reaction (WR), conclude.
1. Explain the essence of bacteriological diagnosis of dysentery. Record biochemistry and carry out serological identification of coproculture, obtained from the patient. Conclude.
2. Carry out serologic diagnostics of brucellosis. Account the Wright's reaction results. Conclude.
16. Recommended literature

Main:

Additional:

17. Web sources
1. Official website of the President of Ukraine http://www.president.gov.ua/
2. Verkhovna Rada of Ukraine http://www.rada.gov.ua/
13. Centers for diseases control and prevention [www.cdc.gov]