Ministry of Science and Higher Education of the Russian Federation
Federal State Autonomous Institution of Higher Education
“National Research Nuclear University “MEPhI”

INSTITUTE OF ENGINEERING PHYSICS FOR BIOMEDICINE

APPROVED НТС ИФИБ

Protocol No. 3.1

dated 30.08.2024

# ACADEMIC COURSE OUTLINE

КЛИНИЧЕСКАЯ ФАРМАКОЛОГИЯ / CLINICAL PHARMACOLOGY

Educational program track (speciality) [1] 31.05.01 General Medicine

| **Semester** | **Labour input, credits** | **Total course academic, hours** | **Lectures, hrs.** | **Practical sessions, hrs.** | **Laboratory sessions, hrs.** | **In the form of practical studies, hrs.** | **Independent studies, hrs.** | **Independent studies monitoring, hrs.** | **Course progress, Exam/Pass-fail exam/Term** |
|---|---|---|---|---|---|---|---|---|---|
| 9 | 3 | 108 | 20 | 40 | 0 | | 48 | 0 | PFE |
| Total | 3 | 108 | 20 | 40 | 0 | 18 | 48 | 0 | |

## ABSTRACT

The program includes the study of the fundamental principles of drug action, their pharmacokinetics and pharmacodynamics, the characteristics of drug interactions, as well as the characteristics of their use in various clinical situations, taking into account age and physiological factors. During the course, students learn methods for evaluating the effectiveness and safety of drug therapies and develop skills in prescribing, adjusting doses, and monitoring drug treatment in a clinical setting. Particular attention is paid to modern approaches to the treatment of diseases, the use of new drugs, and technologies for individualizing treatment. The program is aimed at developing students' clinical thinking and ability to use pharmacological knowledge to make informed decisions during the treatment of patients.


## 1. ACADEMIC COURSE GOALS AND OBJECTIVES

The goal of the course is to develop competencies in the pharmacotherapy of diseases and the monitoring of the effectiveness and safety of prescribed treatments.

Objectives of the discipline:

- to develop knowledge of the pharmacokinetics and pharmacodynamics of the main groups of drugs used in diseases of internal organs and emergency conditions;
- to develop a system of knowledge about changes in the pharmacokinetics and pharmacodynamics of drugs in disorders of various organs and systems; about interactions between the main groups of drugs; adverse drug reactions; indications and contraindications for the use of drugs; and the results of significant randomized controlled trials of drugs;
- developing the skills necessary for a physician to conduct effective, safe, individualized, and controlled pharmacotherapy of patients by selecting drugs, their dosing regimens, and using adequate methods to monitor efficacy and safety.

To Know

- the clinical and pharmacological characteristics of the main groups of drugs and their purpose, the concept of pharmacokinetics and pharmacodynamics of drugs;
- the general principles of pharmacotherapy of diseases, rational selection, drug interactions, indications and contraindications for the use of the main groups of drugs;
- methods for monitoring the effectiveness and safety of pharmacotherapy;

## 2. PLACE OF THE ACADEMIC COURSE IN THE MAIN HIGHER EDUCATION CURRICULUM

The study of clinical pharmacology is based on the knowledge, skills, and abilities acquired in the study of such disciplines as normal and pathological physiology, pathological anatomy, pharmacology, radiopharmaceuticals, medical microbiology and virology, and medical informatics. The knowledge, abilities, and skills acquired as a result of mastering this discipline are necessary for the study of all clinical disciplines and practices.

## 3. DEVELOPED COMPETENCIES AND INTENDED LEARNING OUTCOMES

Universal and/or general professional competencies:

| Competency code and title | Code and title of competency-based rubrics |
|---|---|
| ОПК-7 [1] – Capable of prescribing treatment and monitoring its effectiveness and safety. | З-ОПК-7 [1] – Know: - pharmacological groups of medicinal drugs and their intended purposes; - mechanisms of action of pharmacological and non-pharmacological treatments, indications and contraindications for their use, side effects, and complications caused by their application; - methods for monitoring the effectiveness and safety of various treatment approaches.<br>У-ОПК-7 [1] – Be able to: - make rational choices for pharmacological and non-pharmacological treatments based on clinical guidelines and in accordance with medical care standards; - develop a treatment plan for a disease or condition considering the diagnosis, age, disease course characteristics, and comorbidities, based on clinical guidelines and medical care standards; - prescribe medications, medical devices, and therapeutic nutrition considering the diagnosis, age, disease course characteristics, and comorbidities, based on clinical guidelines and medical care standards; - justify prescribed pharmacological and non-pharmacological treatments; - evaluate the effectiveness and safety of medications, medical devices, therapeutic nutrition, and other treatment methods.<br>В-ОПК-7 [1] – Possess skills in: - administering medications through various routes of administration; - developing treatment plans for diseases or conditions considering diagnosis, age, disease course characteristics, and comorbidities; - assessing the effectiveness and safety of prescribed treatments. |
| ОПК-9 [1] – Capable of implementing quality management principles in professional activities. | З-ОПК-9 [1] – Know: - principles of quality management; The concept of quality of medical care; - procedure for providing medical care to the adult population in the "Therapy" specialty; - procedure for prescribing medications.<br>У-ОПК-9 [1] – Be able to: - analyze the results of one's own professional activities to prevent errors; - apply medical care standards and clinical guidelines (treatment protocols) in practical work; - evaluate the correctness of chosen methods of prevention, diagnosis, treatment, and rehabilitation when providing medical care to a specific patient; - assess the degree of achievement of the planned treatment outcome.<br>В-ОПК-9 [1] – Possess skills in: - making medical decisions based on evidence-based medicine (selection of diagnostic, treatment, prevention, and rehabilitation methods), including using electronic knowledge bases; - applying the procedure for prescribing medications; - participating in the assessment of the quality of medical care provided. |

Professional competencies in compliance with the goals and professional knowledge areas:

| Professional activity goal | Professional activity knowledge area | Professional competency code and title;<br>Based on the | Code and title of competency-based rubrics |
|---|---|---|---|

| | | | |
|---|---|---|---|
| | | **professional standard, experience analysis** | |
| research | | | |
| Analysis of scientific literature and official statistical reviews, participation in statistical analysis and public presentation of the results obtained. | Individuals (patients); the population; the set of means and technologies aimed at creating conditions for preserving and strengthening the health of the adult population | ПК-3.6 [1] - Able to analyze and publicly present medical research information<br><br>*The base:*<br>Professional standard: 02.019 | З-ПК-3.6[1] - Know: - essence of research activities in medicine and healthcare, stages of medical research, design options; - types of scientific information sources, requirements for scientific text formatting and numerical data presentation; - main methods of statistical analysis.;<br>У-ПК-3.6[1] - Be able to: - plan medical research and create databases for subsequent statistical processing; - search, select and analyze scientific information according to research objectives.;<br>В-ПК-3.6[1] - Possess skills in: - preparing informational and analytical materials, including for public presentation of research results (presentation, report, abstract, article); - analyzing research results, their generalization and critical evaluation. |
| Solution of certain scientific research problems and scientific and applied tasks in the field of healthcare related to diagnosis, treatment, medical rehabilitation, and prevention. | Individuals (patients); the population; the set of means and technologies aimed at creating conditions for preserving and strengthening the health of the adult population | ПК-3.7 [1] - Able to participate in implementing research results into practical healthcare activities regarding diagnosis, treatment, medical rehabilitation and prevention.<br><br>*The base:*<br>Professional standard: 02.019 | З-ПК-3.7[1] - Know: - main provisions of regulatory framework for research activities in healthcare; - principles of evidence-based medicine.;<br>У-ПК-3.7[1] - Be able to: - apply results of medical research for patient benefit based on evidence-based medicine.; |

| | | | |
|---|---|---|---|
| | | | В-ПК-3.7[1] - Possess skills in: - using research results in practical healthcare activities regarding diagnosis, treatment, medical rehabilitation and prevention. |

## 4. PEDAGOGIC POTENTIAL OF THE COURSE

| Pedagogic tracks/objectives | Pedagogic goals (code) |
|---|---|
| Professional education | Establishing conditions for: formation of responsibility for professional choice, professional development and professional decisions (B18) |
| Professional education | Establishing conditions for: formation of motivation to improve the quality of medical care to the population and the desire to follow the rules and norms of interaction between the doctor, colleagues and the patient, contributing to the creation of the most favorable environment for the patient's recovery (B34) |

## 5. ACADEMIC COURSE STRUCTURE AND CONTENT

Academic course sections, their scope, terms of study and assessment:

| No. | Academic course section name | Weeks | Lectures/ Practical (seminars)/ Laboratory sessions, hrs. | Compulsory current assessment (form*, week) | Maximum grade per section** | Section assessment (form*, week) | Competency-based rubrics |
|---|---|---|---|---|---|---|---|
| | *9 Semester* | | | | | | |
| 1 | General issues of clinical pharmacology | 1-8 | 10/20/0 | T-8 (25) | 25 | T-8 | З-ОПК-7, У-ОПК-7, В-ОПК-7, З-ОПК-9, У-ОПК-9, В-ОПК-9, З-ПК-3.6, У-ПК-3.6, В-ПК-3.6, З-ПК-3.7, У-ПК-3.7, В-ПК-3.7 |
| 2 | Specific issues in clinical pharmacology | 9-16 | 10/20/0 | T-15 (25) | 25 | T-15 | З-ОПК-7, У-ОПК-7, В-ОПК-7, |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | З-ОПК-9, У-ОПК-9, В-ОПК-9, З-ПК-3.6, У-ПК-3.6, В-ПК-3.6, З-ПК-3.7, У-ПК-3.7, В-ПК-3.7 |
| | *Totals for 9 Semester* | | 20/40/0 | | 50 | | |
| | **Assessment events for 9 Semester** | | | | 50 | PFE | З-ОПК-7, У-ОПК-7, В-ОПК-7, З-ОПК-9, У-ОПК-9, В-ОПК-9 |

* – abbreviated name of assessment

** – 100 maximum points per semester including a pass/fail exam and (or) an exam

Abbreviated current assessment forms and section assessment

| **Abbreviation** | **Full name** |
|---|---|
| T | Testing |
| PFE | Pass/fail examination |

## SYLLABUS

| **Weeks** | **Topics / Content** | **Lect., hrs.** | **Pr./sem., hrs.** | **Lab., hrs.** |
|---|---|---|---|---|
| | *9 Semester* | 20 | 40 | 0 |
| **1-8** | **General issues of clinical pharmacology** | 10 | 20 | 0 |
| 1 - 4 | **General issues of clinical pharmacology. Clinical pharmacology of drugs used in the treatment of cardiovascular diseases**<br>Concepts of pharmacokinetics and pharmacodynamics. Study of bioavailability, drug metabolism, absorption characteristics, distribution, depending on the patient's age, body mass index, and concomitant diseases. Clinical pharmacology of antianginal and hypolipidemic agents. Basic principles of pharmacotherapy for chronic coronary artery disease and hyperlipidemia. Clinical pharmacology of antihypertensive drugs. Basic principles of pharmacotherapy for arterial hypertension. Clinical pharmacology of drugs used in chronic and acute heart failure. Basic principles of pharmacotherapy for chronic and acute heart failure. Clinical pharmacology of antiarrhythmic drugs. Basic principles of pharmacotherapy for cardiac arrhythmias. | All<br>4<br>Online<br>0 | 10<br>0 | 0<br>0 |
| 5 - 8 | **Clinical pharmacology of drugs affecting the blood coagulation system. Clinical pharmacology of drugs used in bronchial obstruction syndrome.** | All<br>6<br>Online | 10 | 0 |

| | | | | |
|---|---|---|---|---|
| | Antithrombotic agents (antiplatelet agents and anticoagulants) used in the treatment of chronic coronary artery disease; key points of their pharmacodynamics, pharmacokinetics, most significant side effects, indications and contraindications for their use, rational dosing regimen and route of administration for various forms of chronic IHD. Classification, pharmacokinetics, pharmacodynamics of direct and indirect anticoagulants, thrombolytics. Classification of drugs currently used for bronchial obstruction syndrome; main groups of bronchodilators, their pharmacodynamics, pharmacokinetics, most significant side effects, indications and contraindications for use; expectorants and mucolytics, their pharmacodynamics, pharmacokinetics, most significant side effects, indications and contraindications for use. | 0 | 0 | 0 |
| **9-16** | **Specific issues in clinical pharmacology** | 10 | 20 | 0 |
| 9 - 12 | **Clinical pharmacology of antibacterial agents. Selection of antibacterial drugs for infectious and inflammatory diseases. Clinical pharmacology of hypoglycemic drugs.**<br>Clinical pharmacology of antibacterial agents. Selection of antibacterial drugs for infectious and inflammatory diseases. Clinical pharmacology of hypoglycemic drugs.<br>Classification of antibacterial agents; general characteristics of antibacterial drugs; causes and mechanisms of secondary resistance of microorganisms to antibacterial agents; pharmacodynamics (mechanism, spectrum of action, and pharmacological effect), pharmacokinetics (routes of administration, bioavailability, plasma protein binding, tissue penetration, time to maximum blood concentration and maintenance of therapeutic concentration, frequency of administration, elimination characteristics), adverse effects, indications and contraindications for the use of antibacterial drugs (beta-lactams, aminoglycosides, macrolides, lincosamides, tetracyclines, rifamycins, glycopeptides, chloramphenicol, sulfonamides, quinolones, nitrofurans, nitroimidazoles, quinoxalines, oxazolidinones); selection of antibacterial drugs for infectious and inflammatory diseases. Clinical pharmacology of insulin, sulfonylureas, biguanides, and other oral hypoglycemic agents.<br>Pharmacotherapy of mental disorders. Clinical pharmacology of neuroleptics and tranquilizers. Clinical pharmacology of hypnotics and antiparkinsonian agents. Acute cerebrovascular accident. Pharmacotherapy of cerebrovascular disorders. Clinical pharmacology of nootropics | All<br>6<br>Online<br>0 | 10<br><br><br>0 | 0<br><br><br>0 |
| 13 - 16 | **Clinical pharmacology of anti-inflammatory drugs. Clinical pharmacology of drugs used in the treatment of digestive system diseases.**<br>Clinical pharmacology of anti-inflammatory drugs. Clinical pharmacology of drugs used in the treatment of digestive system diseases.<br>Basic principles of pharmacotherapy for diffuse connective tissue diseases. Clinical pharmacology of nonsteroidal anti-inflammatory drugs and glucocorticoids. Clinical | All<br>4<br>Online<br>0 | 10<br><br><br>0 | 0<br><br><br>0 |

| | | | | |
|---|---|---|---|---|
| | pharmacology of basic anti-inflammatory drugs. Nonspecific infections of bones and joints.<br>Pharmacokinetics and pharmacodynamics, metabolic characteristics, main side effects, drug interactions of antacids, acid-reducing drugs (PPIs, H2 antagonists), antidiarrheal drugs, prokinetics, drugs for the treatment of inflammatory bowel diseases, drugs for the treatment of liver and biliary tract diseases. Features of the use of drugs in pediatrics and in special patient groups | | | |

Abbreviated names of online options:

| **Abbreviation** | **Full name** |
|---|---|
| EC | E-course |
| FtM | Full-text material |
| FtL | Full-text lectures |
| VM | Video materials |
| AM | Audio materials |
| Prs | Presentations |
| T | Tests |
| ERM | E-reference materials |
| IS | Interactive site |

PRACTICAL SESSIONS TOPICS

| **Weeks** | **Topics / Content** |
|---|---|
| | *9 Semester* |
| 1 - 2 | **General issues of clinical pharmacology**<br>Concepts of pharmacokinetics and pharmacodynamics. Study of bioavailability, drug metabolism, absorption characteristics, distribution, depending on the patient's age, body mass index, and concomitant diseases. |
| 3 - 4 | **Clinical pharmacology of drugs used in the treatment of cardiovascular diseases**<br>Clinical pharmacology of antianginal and hypolipidemic agents. Basic principles of pharmacotherapy for chronic coronary artery disease and hyperlipidemia. Clinical pharmacology of antihypertensive agents. Basic principles of pharmacotherapy for arterial hypertension. Clinical pharmacology of drugs used in chronic and acute heart failure. Basic principles of pharmacotherapy for chronic and acute heart failure. Clinical pharmacology of antiarrhythmic drugs. Basic principles of pharmacotherapy for cardiac arrhythmias |
| 5 - 6 | **Clinical pharmacology of drugs affecting the blood coagulation system**<br>Antithrombotic agents (antiplatelet agents and anticoagulants) used in the treatment of chronic coronary artery disease; key points of their pharmacodynamics, pharmacokinetics, most significant side effects, indications and contraindications for their use, rational dosing regimen and route of administration for various forms of chronic IHD. Classification, pharmacokinetics, pharmacodynamics of direct and indirect anticoagulants, thrombolytics. |
| 7 - 8 | **Classification of drugs currently used for bronchial obstruction syndrome**<br>main groups of bronchodilators, their pharmacodynamics, pharmacokinetics, most significant side effects, indications and contraindications for use; Expectorants and mucolytics, their pharmacodynamics, pharmacokinetics, most significant side effects, indications and contraindications for use. Clinical pharmacology of drugs used in bronchial obstruction syndrome. Basic principles of pharmacotherapy for bronchial asthma and COPD |
| 9 - 10 | **Classification of antibacterial agents; general characteristics of antibacterial drugs** |

| | |
|---|---|
| | causes and mechanisms of secondary resistance of microorganisms to antibacterial agents; pharmacodynamics (mechanism, spectrum of action, and pharmacological effect), pharmacokinetics, adverse effects, indications and contraindications for the use of antibacterial drugs (beta-lactams, aminoglycosides, macrolides, lincosamides, tetracyclines, rifamycins, glycopeptides, chloramphenicol, sulfonamides, quinolones, nitrofurans, nitroimidazoles, quinoxalines, oxazolidinones); selection of antibacterial drugs for infectious and inflammatory diseases. |
| 11 - 12 | **Classification of antifungal and antiviral agents**<br>General characteristics of drugs; causes and mechanisms of secondary resistance of microorganisms; pharmacodynamics (mechanism, spectrum of action, and pharmacological effect), pharmacokinetics, adverse effects, indications, and contraindications for prescribing drugs |
| 13 | **Clinical pharmacology of insulin and other oral hypoglycemic agents**<br>Clinical pharmacology of insulin, sulfonylureas, biguanides, and other oral hypoglycemic agents |
| 14 | **Clinical pharmacology of hypnotics and antiparkinsonian agents**<br>Acute cerebrovascular accident. Pharmacotherapy of cerebral circulation disorders. Clinical pharmacology of nootropics |
| 15 | **Basic principles of pharmacotherapy for diffuse connective tissue diseases**<br>Clinical pharmacology of nonsteroidal anti-inflammatory drugs, glucocorticoids. Clinical pharmacology of basic anti-inflammatory drugs. Nonspecific infections of bones and joints |
| 16 | **Pharmacokinetics and pharmacodynamics**<br>Features of metabolism, main side effects, drug interactions of antacids, acid-reducing drugs (PPIs, H2 antagonists), antidiarrheal drugs, prokinetics, drugs for the treatment of inflammatory bowel diseases, drugs for the treatment of liver and biliary tract diseases. Features of the use of drugs in pediatrics and in special patient groups |

## 6. EDUCATIONAL TECHNOLOGIES

The teaching process utilizes methods based on modern achievements in science and information technologies in education. These methods are aimed at improving the quality of training by developing students' creative abilities and independence. To this end, both traditional teaching methods (lectures, clinical practical classes) and interactive forms of seminars and clinical case studies are used:

- training forms of practical classes (clinical situational tasks, case studies, role-playing in the form of clinical case studies or patient care);
- interactive clinical analysis with patient demonstrations;
- involvement of students in scientific preclinical and clinical research, preparation of presentation materials, reports, essays, or abstracts.

## 7. ASSESSMENT TOOLKIT

The assessment toolkit ensures verification of the intended learning outcomes achievement (competency-based rubrics) using current, midterm and interim assessment of the course.

The link between developed competencies and their assessment is presented in the following table:

| **Competency** | **Achievement rubrics** | **Assessment activity (Syl 1)** |
|---|---|---|
| ОПК-7 | З-ОПК-7 | PFE, T-8, T-15, T-8, T-15 |

| | | |
|---|---|---|
| | У-ОПК-7 | PFE, T-8, T-15, T-8, T-15 |
| | В-ОПК-7 | PFE, T-8, T-15, T-8, T-15 |
| ОПК-9 | З-ОПК-9 | PFE, T-8, T-15, T-8, T-15 |
| | У-ОПК-9 | PFE, T-8, T-15, T-8, T-15 |
| | В-ОПК-9 | PFE, T-8, T-15, T-8, T-15 |
| ПК-3.6 | З-ПК-3.6 | T-8, T-15 |
| | У-ПК-3.6 | T-8, T-15 |
| | В-ПК-3.6 | T-8, T-15 |
| ПК-3.7 | З-ПК-3.7 | T-8, T-15 |
| | У-ПК-3.7 | T-8, T-15 |
| | В-ПК-3.7 | T-8, T-15 |

**Educational achievement rubrics scales**

The scale of each assessment activity varies from 0 to the maximum established point, inclusive. The final assessment of the course is performed on a 100-point scale and represents the sum of the points earned by the student in the section assessments, framework of current and interim assessment.

Sections and interim assessments are considered passed when the student achieves a minimum score equal to 60% of the maximum. The final grade is assigned only upon passing all sections and the interim assessment.

The final grade is assigned in accordance with the following scale:

<table>
<tr><th>Total score</th><th>Rating on a 4-point scale</th><th>Pass/fail examination</th><th>ECTS assessment</th></tr>
<tr><td>90-100</td><td>5 – «excellent»</td><td rowspan="7">«pass»</td><td>A</td></tr>
<tr><td>85-89</td><td rowspan="2">4 – «good»</td><td>B</td></tr>
<tr><td>75-84</td><td>C</td></tr>
<tr><td>70-74</td><td rowspan="2">D</td></tr>
<tr><td>65-69</td><td rowspan="2">3 – «satisfactory»</td></tr>
<tr><td>60-64</td><td>E</td></tr>
<tr><td>below 60</td><td>2 – «fail»</td><td>«fail»</td><td>F</td></tr>
</table>

An “excellent” grade indicates a deep and solid mastery of the program material by a student who presents their answers consistently, clearly, and logically, is able to closely link theory with practice, and uses materials from monographic literature in their answers.

A “good” grade corresponds to a student’s solid knowledge of the material, who presents their answers competently and to the point, without any significant inaccuracies.

A “satisfactory” grade corresponds to the basic level of mastery of the material by the student, in which the main material has been mastered, but its details have not been assimilated, the answers contain inaccuracies, insufficiently correct wording and logical inconsistencies.

A grade “pass” corresponds to at least a basic level of mastery of the program material, in which the student possesses the necessary knowledge, skills, and abilities, and is able to apply theoretical principles to solve typical practical problems.

A grade “fail” is given to a student who lacks a significant understanding of the curriculum material, makes significant errors in their answers, or fails all required assignments. These students are generally unable to continue their studies without additional classes.

## 8. ACADEMIC COURSE EDUCATIONAL, METHODOLOGICAL AND INFORMATIONAL SUPPORT

CORE READING:

1. ЭИ P56 Pharmacology. Illustrated textbook : учебник, Alyautdin R.N., Москва: ГЭОТАР-Медиа, 2020

2. ЭИ К 89 Клиническая фармакология : Рекомендовано ГБОУ ВПО "Первый Московский государственный медицинский университет имени И.М. Сеченова" в качестве учебника для студентов учреждений высшего профессионального образования, обучающихся пооспециальностям "Лечебное дело", "Педиатрия", "Фармация" по дисциплине "Клиническая фармакология",  , Москва: ГЭОТАР-Медиа, 2021

3. ЭИ В26 Клиническая фармакология : учебник, Вебер В. Р., Москва: ГЭОТАР-Медиа, 2023

4. ЭИ К 64 Клиническая фармакология : учебник и практикум для вузов, Коноплева Е. В., Москва: Юрайт, 2025

5. ЭИ К 49 Клиническая фармакология. Общие вопросы клинической фармакологии : практикум : Гриф Минобрнауки России. Рекомендовано ГБОУ ВПО "Московская медицинская академия имени И.М. Сеченова" в качестве учебного пособия для студентов высшего профессионального образования, обучающихся по специальностям 060101.65 "Лечебное дело", 060103.65 "Педиатрия", 060105.65 "Медико-профилактическое дело".,  , Москва: ГЭОТАР-Медиа, 2013

FURTHER READING:

1. ЭИ C61 Clinical Pharmacology: Current Topics and Case Studies : ,  , Cham: Springer International Publishing, 2016

2. ЭИ C49 The hands-on guide to clinical pharmacology / : , Chatu, Sukhdev. , Tofield, Christopher. , : S Chatu Previous editions, 2010

SOFTWARE:

No special softwares is required

LMS AND ONLINE RESOURCES

https://online.mephi.ru/

http://library.mephi.ru/

## 9. LOGISTICAL SUPPORT

1. Персональный компьютер: Моноблок Lenovo V540-24IWL All-In-One 23,8" i3-8145U 8Gb 256GB_SSD_M.2 Intel (64-305)

2. Мышь, клавиатура (64-305)

3. Видеокамера Microsoft LifeCam Cinema HD (64-305)

4. Интерактивная доска SMART SBM 685 (64-305)

5. Проектор SMART P109 (64-305)

6. Мебель лабораторная, стулья, шкафы для хранения (64-305)

7. Мойка лабораторная (64-305)

8. Учебно-научная лаборатория молекулярно-клеточных технологий и экспериментальных in vivo исследований (64-207-209-503)

## 10. EDUCATIONAL AND METHODOLOGICAL RECOMMENDATIONS FOR STUDENTS

Before you begin studying the topic, you need to familiarize yourself with the main questions of the practical lesson plan and the list of recommended literature.

When preparing for a practical lesson, you should first review lecture notes, textbook sections, and teaching aids to gain a general understanding of the topic's place and significance in the course being studied. Then, consult additional literature and take notes on the recommended sources.

In the process of studying the recommended material, it is necessary to understand the structure of the topic being studied, identify the main points, follow their logic and thereby delve into the essence of the problem being studied.

It is necessary to keep records of the material being studied in the form of notes, which, along with visual memory, also includes motor memory and allows for the accumulation of an individual fund of auxiliary materials for the rapid repetition of what has been read, for the mobilization of accumulated knowledge

Basic note-taking forms: outline (simple and detailed), excerpts, and abstracts. During preparation, it is important to compare sources, consider the material being studied, develop an action plan, and carefully consider your oral presentation.

Recommendations for preparing for the test.

Test – 10-15-20-25 points. Each question – 1 (2) point.

TOPICS: Specified in each specific section

Answer requirements: A clear, detailed answer (2 points/question) or a choice of the correct answer to the test question (1 point/question).

Recommendations for preparing for a test/exam

Response requirements and evaluation criteria:

An "excellent" grade of 45-50 points on a test/exam is awarded for: a correct, complete, and logically constructed answer; the ability to use specialized terminology; the ability to illustrate theoretical principles with practical material.

A "good" grade of 35–44 points on the exam is awarded for: a correct, complete, and logically constructed answer with minor errors or inaccuracies; the ability to use specialized terminology, but incomplete conclusions or generalizations are made.

A “satisfactory” grade of 30–34 points on the exam is given for: a schematic, incomplete answer; inability to use special terms or ignorance of them; with one serious error;

An "unsatisfactory" grade of <30 points on the exam is given for: answering all questions on the ticket with serious errors; inability to use specialized terminology; inability to give examples of the practical use of scientific knowledge.

Admission to the exam in a discipline is granted based on a score of over 30 points.

A student can earn between 30 and 50 points per semester.

The minimum score for an exam answer is 30, the maximum is 50.

## 11. EDUCATIONAL AND METHODOLOGICAL RECOMMENDATIONS FOR TEACHERS

Grading and criteria for tests, written assignments, homework, and final exams:

1) - Tests are graded on a scale of 1 point per correct answer. If a student did not attempt the test, they receive (-1) point.

2) - Tests with detailed answers are graded according to the following scheme: complete answer – 2 points, incomplete answer – 1 point, no answer – 0 points, student did not attempt the test – (-2) points.

3) – Homework must be completed by all students in order to be admitted to the final assessment. Late work will result in a deduction of (-1) point from the final score.

4) - Criteria for evaluating presentations. Conversion from a 100-point to a 10 (5)-point system

5) - Criteria for evaluating essays. Maximum 10 points. May be converted to a 5-point system

10 points are awarded if all the requirements for writing an essay are met: the problem is identified and its relevance is justified, a brief analysis of the problem under consideration is made and one's own position is logically presented, conclusions are formulated, the article is analyzed in full, the volume is maintained, and the formatting requirements are met.

9 points are awarded if the following requirements for writing an abstract are met: the problem is identified and its relevance is justified, a brief analysis of the problem under consideration is provided, and the author's position is logically presented, conclusions are formulated, the article is analyzed in full, but the length is not maintained and the formatting requirements are not met.

8 points – the basic requirements for the abstract have been met, but there are some shortcomings. In particular, there are inaccuracies in the presentation of the material; there is a lack of logical consistency in the arguments; the abstract does not meet the required length; there are omissions in the formatting.

7 points – the main requirements for the abstract have been met, but the following shortcomings have been made: there are inaccuracies in the presentation of the material; there is no logical sequence in the arguments; conclusions have not been formulated, the volume of the abstract has not been maintained; there are omissions in the formatting.

6 points – there are significant deviations from the requirements for referencing; the topic is only partially covered; there are factual errors in the content of the abstract, there are no conclusions or personal opinion on the issue.

5 points – there are significant deviations from the requirements for the abstract: the topic is only partially covered; there are factual errors in the presentation of materials and methods, there are no conclusions or personal opinion on the issue, the format is not consistent.

4 points – there are significant deviations from the requirements for the abstract: the relevance of the topic is not disclosed; factual errors are made in the presentation of materials and methods, there are no conclusions and personal opinion on the problem, the format is not consistent

3 points – there is no analysis of the relevance of the research topic, approaches, and methods used, while the length of the abstract is formally observed.

2 points – the topic of the abstract is not revealed, there is a significant misunderstanding of the problem. At the same time, the length of the abstract and formal requirements are met.

1 point – the topic of the essay is not revealed, there is a significant misunderstanding of the problem.

0 points – the essay has not been submitted by the student.

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