

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 ИТС ИФИБ

Protocol No. 3.1

dated 30.08.2024

**ACADEMIC COURSE OUTLINE**

**БИОЛОГИЯ / BIOLOGY**

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

<b>Semester</b>	<b>Labour input, credits</b>	<b>Total course academic, hours</b>	<b>Lectures, hrs.</b>	<b>Practical sessions, hrs.</b>	<b>Laboratory sessions, hrs.</b>	<b>In the form of practical studies, hrs.</b>	<b>Independent studies, hrs.</b>	<b>Independent studies monitoring, hrs.</b>	<b>Course progress, Exam/Pass-fail exam/Term</b>
1	2-3	72-108	16	0	32		24-60	0	PFE
2	5-6	180-216	15	0	30		81-117	0	Ex
Total	7-9	252-324	31	0	62	0	105-177	0	

## **ABSTRACT**

The academic discipline includes topics in general biology and medical parasitology. The academic discipline consists of two sections that are taught to students of medical faculties in the first year.

The section "General Biology" is a basic course for medical specialists, intended to familiarize students with biology as a fundamental natural science discipline. In the first semester students study Cytology and Molecule biology, Classical and Medical Genetics as well as Population Genetics and Evolution. In the second semester students will study main topics in General and medical ecology as well as in Medical parasitology. This part includes topics in Protozoan Parasites of Humans, Medical helminthology and arachnoentomology.

The program has been elaborated according to the State Federal Educational Standards and programs on medical and general biology and parasitology for the students of medical and biological faculties and highlighted the main issues of the academic discipline "General biology and parasitology". The programmer is intended for 1st year students.

### **1. ACADEMIC COURSE GOALS AND OBJECTIVES**

The purpose of studying the academic discipline is to form a holistic view of the properties of living systems, the historical development of life, the role of biota in planetary processes, the current trends, problems and prospects of the biomedical sciences. Knowledge gained in the course of mastering the discipline about the mechanisms of life support at different biological levels provides the basis for the study of professional disciplines.

The aim of the first part of the academic discipline is given the opportunity to master the techniques of microscopy on a light microscope, analyze biological systems, study mitosis and meiosis, as well as stages of ontogenesis, and master methods for solving genetic problems and constructions pedigrees.

The aim of the second part of academic discipline is checking the basic knowledge to students on general aspects of medically important parasites, etiologic agents of diseases, their diagnosis and management.

The academic discipline includes interactive work and knowledge control. Current control is carried out at each class in the form of a report on the previous laboratory classes made in the form of a set of biological sketching and explanations to them

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

The academic discipline belongs to the cycle of basic disciplines and is the basis for the study of such academic disciplines as Medical Biophysics, Biochemistry, Histology, embryology and Cytology, Immunology, Hygiene, Epidemiology and many other disciplines that medical students will study in their senior years.

### 3. DEVELOPED COMPETENCIES AND INTENDED LEARNING OUTCOMES

Universal and/or general professional competencies:

Competency code and title	Code and title of competency-based rubrics
<p>OPIK-5 [1] – Capable of assessing morphofunctional and physiological states, as well as pathological processes in the human body to solve professional tasks.</p>	<p>3-OPIK-5 [1] – Know: - basic medical, pharmaceutical, and morphofunctional terminology, including Latin terms; - structure and functions of the human body, age-related, gender-specific, and individual characteristics of the structure and development of a healthy organism; - physical and chemical nature of processes occurring in a living organism; - patterns of vital activity of the organism, mechanisms of self-regulation and regulation; - features of regulation of the functioning of human body systems in pathological conditions; - patterns of occurrence, development, and outcome of typical pathological processes, the concept of sanogenesis; - etiology and pathogenesis of the most common diseases; - the concept of nosology, principles of disease classification; - principles of microorganism classification, their morphology, physiology, and impact on human health; - structure and functions of the human immune system.</p> <p>Y-OPIK-5 [1] – Be able to: - analyze mechanisms of disease development and manifestation; - recognize morphological and functional changes in cells, tissues, organs, and systems of the human body; - use basic physical-chemical and other natural science concepts and methods in solving professional tasks; - determine the cause of death and formulate a pathological diagnosis.</p> <p>B-OPIK-5 [1] – Possess skills in: - conducting microscopy and analyzing microscopic specimens; - correlating morphological and clinical manifestations of diseases; - assessing morphofunctional, physiological states, and pathological processes in humans; - clinical-anatomical analysis of autopsy results.</p>

### 4. PEDAGOGIC POTENTIAL OF THE COURSE

Pedagogic tracks/objectives	Pedagogic goals (code)
Intellectual education	Establishing conditions for: formation of culture of intellectual work (B11)
Vocational and labor education	Establishing conditions for: formation of a deep understanding of the profession's social role, a positive and active commitment to the values of the chosen specialty, and a responsible attitude towards professional activity and work (B14)

### 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
	<i>1 Semester</i>						
1	The First section	1-8	8/0/16	TstP-4 (10), TstP-8 (15)	25	TstP-8	3-ОПК-5, У-ОПК-5, В-ОПК-5
2	The Second section	9-16	8/0/16	TstP-10 (15), TstP-15 (10)	25	TstP-16	3-ОПК-5, У-ОПК-5, В-ОПК-5
	<i>Totals for 1 Semester</i>		16/0/32		50		
	<b>Assessment events for 1 Semester</b>				50	PFE	3-ОПК-5, У-ОПК-5, В-ОПК-5
	<i>2 Semester</i>						
1	The First Section	1-8	8/0/15	TstP-4 (10), TstP-8 (15)	25	TstP-8	3-ОПК-5, У-ОПК-5, В-ОПК-5
2	The Second Section	9-15	7/0/15	TstP-10 (15), TstP-15 (10)	25	TstP-15	3-ОПК-5, У-ОПК-5, В-ОПК-5
	<i>Totals for 2 Semester</i>		15/0/30		50		
	<b>Assessment events for 2 Semester</b>				50	Ex	3-ОПК-5, У-ОПК-5, В-ОПК-5

\* – 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
TstP	Test paper
PFE	Pass/fail examination
Ex	Exam

## SYLLABUS

Weeks	Topics / Content	Lect., hrs.	Pr./sem., hrs.	Lab., hrs.
	<i>1 Semester</i>			
<b>1-8</b>	<b>The First section</b>	8	0	16
1 - 4	<b>Introduction to molecular biology and genetics</b> Molecular and cellular levels	All		
		0	0	0
		Online		

		4	0	8
5 - 8	<b>The reproduction of biological systems</b> Cell division. Reproduction	All		
		0	0	0
		Online		
		4	0	8
<b>9-16</b>	<b>The Second section</b>	8	0	16
9 - 12	<b>Inherited information and its implementation in the cell</b> Basis of genetics. Medical genetics	All		
		0	0	0
		Online		
		4	0	8
13 - 16	<b>The evolution of the organic world</b> Cyto- and Phylogenetics. Congenital anomalies	All		
		0	0	0
		Online		
		4	0	8
	<i>2 Semester</i>	15	0	30
<b>1-8</b>	<b>The First Section</b>	8	0	15
1 - 4	<b>Biogeocenotic level of wildlife organization</b> General and medical ecology	All		
		0	0	0
		Online		
		2	0	6
5 - 8	<b>Medical parasitology</b> Protozoan Parasites of Humans	All		
		0	0	0
		Online		
		6	0	10
<b>9-15</b>	<b>The Second Section</b>	7	0	15
9 - 12	<b>Medical parasitology</b> Human helminthology	All		
		0	0	0
		Online		
		4	0	8
13 - 15	<b>Medical parasitology</b> Medical arachnoentomology	All		
		0	0	0
		Online		
		3	0	7

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

#### LABORATORY (LAB) SESSIONS TOPICS

Weeks	Topics / Content
	<i>1 Semester</i>

1 - 4	<b>Introduction to molecular biology and genetics</b> Molecular basis of life
5 - 8	<b>The reproduction of biological systems</b> Cell division. Reproduction
9 - 12	<b>Inherited information and its implementation in the cell</b> Basis of genetics. Medical genetics
13 - 16	<b>The evolution of the organic world</b> Cyto- and Phylogenetics. Congenital anomalies
	<i>2 Semester</i>
1 - 4	<b>Ecology and parasitology</b> Solving situational and test tasks on the topic
5 - 8	<b>Protistology</b> Solving situational and test tasks on the topic
9 - 12	<b>Helmintology</b> Solving situational and test tasks on the topic
13 - 15	<b>Arahoentomology</b> Solving situational and test tasks on the topic

## 6. EDUCATIONAL TECHNOLOGIES

Teaching methods include the use of multimedia, interactive teaching methods and laboratory equipment to acquire theoretical knowledge and practical skills.

For self-preparation for practical classes and exams, students are given access to full-text textbooks and articles from electronic databases:

1. [www.isir.ras.ru/](http://www.isir.ras.ru/) - Integrated Information Resources System of the Russian Academy of Sciences.
2. [www.merlot.org/merlot/materials.htm?category=2608&&sort.property=overallRating](http://www.merlot.org/merlot/materials.htm?category=2608&&sort.property=overallRating) - MERLOT - Multimedia Educational Resource for Learning and Online Teaching. Section "Biology"
3. [www.nature.ru](http://www.nature.ru) - Textbooks, scientific monographs, reviews, laboratory workshops in free access on the website of the journal Nature.
4. Test tasks on topics on electronic media.

## 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)	Assessment activity (Syl 2)
ОПК-5	3-ОПК-5	PFE, TstP-8, TstP-16, к.р-4, к.р-8, к.р-10, к.р-15	Ex, TstP-8, TstP-15, к.р-4, к.р-8, к.р-10, к.р-15
	У-ОПК-5	PFE, TstP-8, TstP-16, к.р-4, к.р-8, к.р-10,	Ex, TstP-8, TstP-15, к.р-4, к.р-8, к.р-10,

		к.р-15	к.р-15
	B-ОПК-5	PFE, TstP-8, TstP-16, к.р-4, к.р-8, к.р-10, к.р-15	Ex, TstP-8, TstP-15, к.р-4, к.р-8, к.р-10, к.р-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:

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

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 В56 Biology : учебник, Donskova S.A. [и др.], Москва: ГЭОТАР-Медиа, 2024
2. ЭИ Б63 Биология. В 2 томах. Том 1. : учебник, , Москва: ГЭОТАР-Медиа, 2018
3. ЭИ Б63 Биология. В 2 томах. Том 2. : учебник, , Москва: ГЭОТАР-Медиа, 2018

### **FURTHER READING:**

1. ЭИ М79 Molecular and Cellular Biology of Platelet Formation : Implications in Health and Disease, , Cham: Springer International Publishing, 2016
2. ЭИ М79 Molecular and Cellular Mechanobiology : , , New York, NY: Springer New York, 2016
3. ЭИ К 59 Биология : Министерство образования и науки РФ Рекомендовано ГБОУ ВПО "Первый Московский государственный медицинский университет имени И.М. Сеченова" в качестве учебника для образовательных учреждений начального профессионального и специальностей среднего профессионального образования по дисциплине "Биология" Регистрационный номер рецензии 026 от 03 февраля 2015 года ФГАУ "Федеральный институт развития образования", Волков И.Н., Козлова И.И., Мустафин А.Г., Москва: ГЭОТАР-Медиа, 2018
4. ЭИ М42 Медицинская паразитология : учебник, , Москва: ГЭОТАР-Медиа, 2020
5. ЭИ М 15 Медицинская паразитология. Атлас : , Макеев О. Г. [и др.], Санкт-Петербург: Лань, 2022

### **SOFTWARE:**

1. Microsoft Office 2016+ ( )
2. Microsoft Word (К64-303 )

### **LMS AND ONLINE RESOURCES**

1. 1 part Biology ([https://online.mephi.ru/1 part Biology](https://online.mephi.ru/1%20part%20Biology))
2. 2 part Biology (<https://online.mephi.ru/>)

<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 (64-303)

2. Мышь, клавиатура (64-303)
3. Интерактивная доска SMART SBM 685 (64-303)
4. Проектор SMART P109 (64-303)
5. Мебель лабораторная, стулья, шкафы для хранения (64-303)
6. Мойка лабораторная (64-303)
7. Бинокулярные микроскопы "Микромед 2" (64-303)
8. Тринукулярный микроскоп "Микромед-3" (64-303)
9. Видеоокуляр ToprCam 5,1 MP (64-303)
10. Наборы микропрепаратов "Общая паразитология" (64-303)
11. Набор микропрепаратов по генетике (64-303)
12. Набор микропрепаратов "Кишечнополостные и губки" (64-303)
13. Набор микропрепаратов "Простейшие" (64-303)
14. Набор микропрепаратов "Паукообразные и многоножки" (64-303)
15. Набор микропрепаратов "Эмбриология лягушки (Rana)" (64-303)
16. Набор микропрепаратов "Митоз и мейоз" (64-303)
17. Персональный компьютер: Моноблок Lenovo V540-24IWL All-In-One 23,8" i3-8145U 8Gb 256GB\_SSD\_M.2 Intel (64-304)
18. Мышь, клавиатура (64-304)
19. Интерактивная доска SMART SBM 685 (64-304)
20. Проектор SMART P109 (64-304)
21. Мебель лабораторная, стулья, шкафы для хранения (64-304)
22. Мойка лабораторная (64-304)
23. Шкаф лабораторный вытяжной "Лабтех" ШВ202 (64-304)
24. Бинокулярные микроскопы "Микромед 2" (64-304)
25. Тринулярный микроскоп "Микромед 1" (64-304)
26. Видеоокуляр ToprCam 10,0 MP (64-304)
27. Наборы микропрепаратов "Общая паразитология" (64-304)
28. Набор микропрепаратов "Митоз и мейоз" (64-304)

29. Персональный компьютер: Моноблок Lenovo V540-24IWL All-In-One 23,8" i3-8145U 8Gb 256GB\_SSD\_M.2 Intel (64-305)
30. Мышь, клавиатура (64-305)
31. Видеокамера Microsoft LifeCam Cinema HD (64-305)
32. Интерактивная доска SMART SBM 685 (64-305)
33. Проектор SMART P109 (64-305)
34. Мебель лабораторная, стулья, шкафы для хранения (64-305)
35. Мойка лабораторная (64-305)
36. Шкаф лабораторный вытяжной "Лабтех" ШВ202 (64-305)
37. Бинокулярные микроскопы "Микромед 2" (64-305)
38. Тринокулярный микроскоп "Микромед 3" (64-305)
39. Видеоокуляр TourCam 10,0 MP (64-305)

## **10. EDUCATIONAL AND METHODOLOGICAL RECOMMENDATIONS FOR STUDENTS**

Since the listed competencies are integral in nature, it is advisable to highlight the planned learning outcomes — the knowledge, skills and abilities that characterize the stages of formation of competencies and ensure the achievement of the planned results of mastering the educational program, to develop assessment tools. So in the result of mastering the discipline "BIOLOGY" students must:

Know (Z):

- the basic biological, physical, chemical, mathematical and other natural science concepts and methods in solving professional problems (Z1)
- the basic general medicine and parasitology concepts and methods in solving professional problems (Z2)

Possess (U):

- public discussion skills

Be able to (B):

- assess morpho-functional, physiological states and pathological processes in the human body to solve professional problems (B1)
- present the results of experimental work in the form of reports and presentations (B2)
- diagnose parasitological diseases based on symptoms and main signs (B3)
- use all instruments and materials necessary for carrying out of medical researches (B4)

Test Single/multiple choice questions

Homework Solving the situation tasks in different fields of general biology and medicine, fill in the table, label the image,

Laboratory class Examination of micropreparations (or microslide) by microscope, sketch and label, explanation

Final test Single/multiple choice questions fill in the table, label the image, solving the tasks

Exam Explanation of concepts, solution of a situational tasks identification of parasitic organisms in micro-preparations (or micro-slides)

## **11. EDUCATIONAL AND METHODOLOGICAL RECOMMENDATIONS FOR TEACHERS**

Grading and criteria for tests, extended quizzes, homework, and the final test:

1) - Tests are graded according to the following formula: 1 point for every 1 correct answer. A student who has not started the test receives -1 point.

2) - Extended quizzes are graded according to the following formula: complete answer -2 points, incomplete answer -1 point, no answer -0 points, student who has not started the test -2 points.

3) - Homework must be completed by all students to be eligible for the final assessment. Late submissions will result in a deduction of -1 point from the final score.

4) - Presentation report grading criteria. Conversion from a 100-point to a 10 (5)-point system

5) - Essay evaluation criteria. Maximum 10 points. May be upgraded to a 5-point system.

10 points are awarded if all essay writing requirements are met: the problem is identified and its relevance justified, a brief analysis of the issue is provided and a logically presented personal position is presented, conclusions are formulated, the article is fully analyzed, the length is maintained, and formatting requirements are met.

9 points are awarded if the following essay writing requirements are met: the problem is identified and its relevance justified, a brief analysis of the issue is provided and a logically presented personal position is presented, conclusions are formulated, the article is fully analyzed, but the length is not maintained and formatting requirements are not met.

8 points - the main essay requirements are met, but some shortcomings are present. In particular, there are inaccuracies in the presentation of the material; there is a lack of logical consistency in the judgments; The abstract's length is not maintained; there are omissions in the formatting.

7 points – the basic abstract requirements are met, but the following shortcomings are present: there are inaccuracies in the presentation of the material; there is a lack of logical consistency in the judgments; conclusions are not formulated, the abstract's length is not maintained; there are omissions in the formatting.

6 points – there are significant deviations from the abstracting requirements; the topic is only partially covered; there are factual errors in the abstract's content, conclusions and a personal point of view on the problem are missing.

5 points – there are significant deviations from the abstract requirements: the topic is only partially covered; there are factual errors in the presentation of materials and methods, conclusions and a personal point of view on the problem are missing, the format is not maintained.

4 points – there are significant deviations from the abstract requirements: the relevance of the topic is not disclosed; Factual errors were made in the presentation of materials and methods, conclusions and personal perspective on the problem are missing, and the format is not followed.

3 points – there is no analysis of the relevance of the research topic, approaches, and methods used, although the formal length of the abstract is met.

2 points – the abstract topic is not covered, revealing a significant misunderstanding of the problem. However, the abstract length and formal requirements are met.

1 point – the abstract topic is not covered, revealing a significant misunderstanding of the problem.

0 points – the student did not submit an abstract.

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Reviewer(s):

prof. AA Kotlyarov, prof. YUE Dubrova / проф. АА Котляров, проф. ЮЕ Дуброва /