

NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF
UKRAINE
PHYSICS DEPARTMENT

“CONFIRMED”

Dean of the Faculty of Plant Protection,
Biotechnology and Ecology
Yulia KOLOMIETS



2024 year.

“APPROVED”

at the meeting of the department Physics
Protocol № 5 dated “07” of May 2024 year.

Head of Department
Volodymyr BOYKO

”REVIEWED”

Program Coordinator _____

Program Coordinator
Myroslav PYKOVSKYI

PROGRAM OF THE COURSE

BIOPHYSICS AND MATHEMATICS

Specialization _____ 202 «Plant protection and quarantine»

Educational program _____ Plant protection and quarantine

Faculty (Institute) _____ Plant Protection, Biotechnology and Ecology

Developers: candidate of physical and mathematical sciences, associate professor Ok-
sana Godlevska

Kyiv – 2024

Field of knowledge, specialization, educational program, educational degree		
Educational degree	<i>Bachelor's</i>	
Specialization	202 «Plant protection and quarantine»	
Educational program	Plant protection and quarantine	
Characteristics of the course		
Type	Compulsory	
Total number of hours	72	
Number of ECTS credits	3	
Number of content modules	2	
Course project (work) (if applicable)	-	
Form of assessment	<i>Exam</i>	
Indicators of the course for full-time and part-time forms of study		
	Full-time form of study	Part-time form of study
Course (year of study)	1	1
Semester	2	2
Lecture classes	15 hr.	30hr.
Practical, seminar classes	-	-
Laboratory classes	30 hr.	30hr.
Self-study	27 hr.	60hr.
Individual assignments	- hr.	-hr.
Number of weekly classroom hours for the full-time form of study	3hr.	-

2. Purpose, objectives, and competencies of the course

The main objective of the course “ Biophysics” is to expose principal laws and theses of physics which make it possible to study general regularities of natural phenomena; to apply the principles and methods of the physical sciences to biological problems; to consider the biophysical problems which are concerned with the viability of agricultural animals and their interaction with the environment; to elucidate possible application of physical instrumentation to plant protection.

The main requirements to the student after studying by him the course “Biophysics” are the following:

The student must know

the main physical quantities and units, principal laws and theses of general physics, theory and practice of measurement errors;

general physical processes and phenomena which take place in the living organism;

the effects of external physical factors on agricultural plant and their interaction with the environment;

possibility of the application of physical instrumentation to plant protection.

The student must be able

to process experimental data and estimate measurement errors;

to explain physical principles and mechanisms of function of living organism;

to use modern physical methods and devices in plant protection practice.

Final control is carried out in the form of tests for each of the modules and an exam.

Acquisition of competencies

The study of the academic discipline "Biophysics" contributes to the fact that, according to this standard, the student is able to acquire:

Integral competencies (IC):

Possess knowledge of the fundamental sections of higher mathematics, biophysics, chemistry (analytical, organic, inorganic, physical and colloidal), botany and agrozoology to the extent necessary for understanding the processes of the specialty plant protection and quarantine.

general competencies (GC):

GC1. Ability to abstract thinking, analysis and synthesis.

GC2. Ability to apply knowledge in practical situations.

GC3. Knowledge and understanding of the subject area and understanding of professional activity.

GC7. Ability to learn and master modern knowledge and search, processing and analysis of information from various sources.

Program learning outcomes (PLO):

PLO4. Possess knowledge of the fundamental sections of higher mathematics, biophysics, chemistry (analytical, organic, inorganic, physical and colloidal), botany and agrozoology to the extent necessary for understanding the processes of the specialty plant protection and quarantine.

3. The program and structure of the educational discipline for:

-full-time education.

Names of content modules and topics	Number of hours													
	Full-time form							Part-time form						
	weeks	total	including					total	including					
			l	p	lab	individual	self		l	p	lab	individual	self	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Content module 1. Mechanics. Acoustics. Thermodynamics.														
Topic 1. Mechanics. Kinematics, dynamics, statics. Elastic properties of bodies.	1-2	7	1		4		2							
Topic 2. Biomechanics	2-3	5	1		2		2							
Topic 3. Hydrodynamics.	3-4	7	1		2		4							
Topic 4. Molecular physics. Temperature and humidity of the environment	4-5	7	3		2		2							
Topic 5. Acoustics, bioacoustics.	5-7	7	1		4		2							
Topic 6. Thermodynamics of equilibrium and irreversible states and processes.	7-8	5	1		2		2							
Together according to content module	38		8		16		14							

1													
Content module 2. Electricity. Magnetism. Optics.													
Topic 1. Electricity, bioelectricity.	9-10	10	2		4		4						
Topic 2. Magnetism, biomagnetism.	11-12	9	2		4		3						
Topic 3. Geometric, wave optics.	13-14	10	2		4		4						
Topic 4. Physiological optics and photobiology	15	5	1		2		2						
Together according to content module 2	34		7		14		13						
Total hours	72		15		30		27						
Course project (work) with _____			-	-	-		-	-	-	-			-
Total hours													

4.Seminar topics

№	Topic title	Number of hours
1		

5.Practical class topics

№	Topic title	Number of hours
1		

6.Laboratory class topics

№	Topic title	Number of hours
1.	Statistical calculations (error, significant figure, rounding).	2

2.	Lab. work 1-1. Determining the acceleration of free fall using a mathematical pendulum	2
3.	Lab. work 1-2. Determination of Young's modulus of elastic substances	2
4.	Lab. work 1-3. Determination of the moment of inertia of a torsional pendulum.	2
5.	Lab. work 2-1. Determination of the rate of sedimentation of bodies and the coefficient of internal friction of a liquid by the Stokes method	2
6.	Lab. work 2-2. Determination of the ratio of specific heat capacities C_p/C_v of gas by the method of adiabatic expansion (Clément-Desormes method).	2
7.	Lab. work 2-3. Determination of the surface tension of a liquid by the droplet separation method.	2
8.	Lab. work 2-4. Determination of entropy change during melting of tin.	2
9.	Lab. work 3-1. Study of the electrostatic field	2
10.	Lab. work 3-2. Determination of the electromotive force of the current source by the compensation method	2
11	Lab. work 4-1. Determination of the specific charge of an electron using the magnetron method.	2
12.	Lab. work 4-2. Determination of the horizontal induction component of the Earth's magnetic field.	2
13.	Lab. work 5-1. Determination of refractive indices using a microscope	2
14.	Lab. work 5-6. Determination of the wavelength of light us-	2

	ing a diffraction grating	
15.	5-8. Determination of Planck's constant by the Lukyrskyi method.	2

7.Independent work topics

№	Topic title	Number of hours
1	Processing of lecture material	10
2	Preparation for laboratory classes	12
3	Preparation for control works (testing)	5

8. Teaching methods.

The following teaching methods are used when teaching the discipline:

1. Lecture.
2. Laboratory work - to use acquired knowledge to solve practical problems.

9. Forms of control

When teaching the discipline, the following forms of control are provided during the semester for full-time students: oral survey and express testing in laboratory classes, defense of reports on individual laboratory tasks, modular control works, exam at the end of the 1st semester.

10. Distribution of grades received by students.

Evaluation of student knowledge is carried out on a 100-point scale and is converted to national grades according to Table 1 "Regulations and Examinations and Credits at NULES of Ukraine" (order of implementation dated 26.04.2023, protocol №10)

Student rating, points	National grade based on exam results	
	Exams	Credits
90-100	Excellent	Passed
74-89	Good	
60-73	Satisfactory	
0-59	Unsatisfactory	Not passed

In order to determine the rating of a student (listener) in the discipline R_{dis} (up to 100 points), the rating from the exam R_{ex} (up to 30 points) is added to the rating of a student's academic work R_{aw} (up to 70 points): $R_{dis} = R_{aw} + R_{ex}$.

11. Educational and methodological support.

All methodological support - lecture material, description of laboratory works and tasks for independent work are available on electronic media and in electronic training courses: for the full term of training - <https://elearn.nubip.edu.ua/course/view.php?id=3836>, for a shortened term of induction -

<https://elearn.nubip.edu.ua/course/view.php?id=2511>, to which students of this specialty are enrolled.

Students learn informational material that is sufficiently covered in educational literature on their own. There is a sufficient amount of recommended literature in the library of NULES of Ukraine.

12. Recommended sources of information

Posudin Yuriy. *Physics with Fundamentals of Biophysic.*- 2d edition.- Kyiv: Printline, 2014.- 209 p.
Physics\ V. Boyko, O. Godlevska, P.Iiin, M. Malyuta\ \ Methodical recommendations for the students, who attend the English-speaking lectures, printed NULE of Ukraine, Kyiv. 2021, p.52

Посудін Ю.І. *Лабораторний практикум з дисципліни «Фізика з основами біофізики» для студентів, що слухають лекції англійською мовою.* К.: 2010.-194 с. (для англomовних груп). Бойко В.В., Відьмаченко А.П., Залоїло І.А., Малюта М.В. Фізика з основами кваліметрії: Навчальний посібник. - К.: Видавництво «Ліра– К», 2018, – 564 с.

Практикум з біофізики : навчальний посібник для вищих навчальних закладів. Ч. I. Біомеханіка / В. В. Бойко, І. А. Залоїло, О. О. Годлевська. - К.: , 2021. - 572 с.

Практикум з біофізики : навчальний посібник для вищих навчальних закладів. Ч. II. Біотермодинаміка. Біоелектрика та біомагнетизм. Фотобіологія. / В. В. Бойко, І. А. Залоїло, Ю.І. Посудін. - К.:, 2019. - 486 с.

Посудін Ю.І. Фізика з основами біофізики. Київ, Світ, 2003.-400 с.

Посудін Ю.І. Лабораторний практикум з дисципліни "Фізика з основами біофізики": Навчальний посібник - Київ, НУБіПУ, 2012.-105 с.

Internet - sources

1. Канал Youtube «КАФЕДРА ФІЗИКИ НУБІП УКРАЇНИ»

<https://www.youtube.com/channel/UCUQ-x3dx5Lw2SL6w9a6DNDg>. Дата звернення: 20.03.2023

2. Механіка. Основні поняття.

URL: <https://www.youtube.com/watch?v=hyEul6F8baw>

Дата звернення: 20.05.2023

3. Молекулярна фізика. Початок термодинаміки.

URL: https://www.youtube.com/watch?v=fo2HE2tu_3I

Дата звернення: 20.05.2023

4. Електростатика. Електроємність. Конденсатори.

URL: <https://www.youtube.com/watch?v=37E2Gc73HaA>

Дата звернення: 20.05.2023

5. Магнетизм. Основи. Електрична і магнітна взаємодії. Індукція магнітного поля.

URL: https://www.youtube.com/watch?v=_jReBOzCFLI

Дата звернення: 20.05.2023

6. Оптика. Основні положення.

URL: https://www.youtube.com/watch?v=v64Vq_k-yHo

дата звернення: 20.05.2023