NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE
PHYSICS DEPARTMENT

"CONFIRMED"
Dean of the Faculty Veterinary Medicine
_____ V.M. CHUK
"___" _____ 2026
year

"APPROVED"
at the meeting of the department Physics
Protocol № 6 dated "3" 06 2026
year
Head of Department
_____ Borys HRUDYNIN

"REVIEWED
Program Coordinator
_____ Volodymyr MELNY

"AGREE
Chairman of the Bioethics Commiss
of the NUBiP of Ukr
_____ Oleg MELN

PROGRAM OF THE COURSE

BIOPHYSICS

Fields of knowledge H «Agriculture, forestry, fisheries and veterinary medicine»

Specialization H6 «Veterinary Medicine»

Educational program Veterinary Medicine

Faculty (Institute) Veterinary Medicine

Developers: candidate of physical and mathematical sciences, associate professor Oksana Godlevska

Kyiv – 2026

NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE
PHYSICS DEPARTMENT

"**CONFIRMED**"
Dean of the Faculty Veterinary Medicine
_____ Oleksandr VALCHUK
"____"_____2026 year

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at the meeting of the department__Physics_____
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1.Description of the course "BIOPHYSICS"

Biophysics studies physical and physico-chemical phenomena in biological objects; its task is to study the fundamental processes that form the basis of living nature.

The main goal of the discipline "Biophysics" is to present to students the basic laws and provisions of physics, which help to study the general patterns of natural phenomena.

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 veterinary practice.

Field of knowledge, specialization, educational program, educational degree		
Educational degree	Master's	
Specialization	H6 «Veterinary Medicine»	
Educational program	Veterinary Medicine	
Characteristics of the course		
Type	Compulsory	
Total number of hours	90	
Number of ECTS credits	3.0	
Number of content modules	2	
Course project (work) (if applicable)	-	
Form of assessment	*Exam*	
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	-
Semester	1	-
Lecture classes	15 hr.	-
Practical, seminar classes	15 hr	-
Laboratory classes	15 hr.	-
Self-study	45 hr.	-
Individual assignments	- hr.	-
Number of weekly classroom hours	3	

for the full-time form of study		

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 veterinary practice.

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 animals and their interaction with the environment;
possibility of the application of physical instrumentation to veterinary practice.

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 veterinary 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 competence (IC):

The ability to solve complex tasks and problems in the field of veterinary medicine, which involves conducting research and/or implementing innovations and is characterized by uncertainty of conditions and requirements.

general competencies (GC):

GC01. Ability to abstract thinking, analysis and synthesis.

GC02. Ability to apply knowledge in practical situations.

GC03. Knowledge and understanding of the subject area and profession.

GC08. Ability to learn and master modern knowledge.

GC13.The ability to make decisions and act in accordance with the principle of non-acceptance of corruption and any other manifestations of dishonesty.

Professional (special) competences (SC):

SC1. The ability to establish the features of the structure and functioning of cells, tissues, organs, their systems and body apparatuses of animals of various classes and species - mammals, birds, insects (bees), fish and other vertebrates.

SC2. The ability to use tools, special devices, devices, laboratory equipment and other technical means to carry out the necessary manipulations during professional activity.

First Day Competencies, in accordance with European Union requirements(FDC):

FDC2: Understand scientific research methods, the contribution of fundamental and applied research to science, and the implementation of the 3Rs principle (Replacement, Reduction, Refinement).

FDC11: Demonstrate the ability to critically analyze evidence, deal with incomplete information, resolve unforeseen situations, and adapt knowledge, skills, and practical abilities to different work situations.

FDC24: Use basic diagnostic equipment and effectively conduct animal examinations as appropriate to the specific case, in accordance with good health and biosafety practices and applicable regulatory documents. Understand the contribution of digital tools and artificial intelligence to the theory and practice of veterinary medicine.

Program learning outcomes (PLO):

PLO1. Know and correctly use the terminology of veterinary medicine.

PLO3. To determine the essence of physico-chemical and biological processes that occur in the body of animals in normal and pathological conditions.

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	indi-vidual	self		l	p	lab	indi-vidu-al	self
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Content module 1. Mechanics. Acoustics. Thermodynamics.													
Topic 1. Mechan-ics. Kinematics, dynamics, statics. Elastic properties of bodies.	1-2	13	1		4		6						
Topic 2. Biome-chanics	2-3	7	1	2			4						
Topic 3. Hydrody-namics.	3-4	8	2		2		4						
Topic 4. Basics of hemodynamics.	4-5	7	1	2			4						
Topic 5. Acoustics, bioacoustics.	5-7	13	1	4			4						
Topic 6. Thermo-dynamics of equi-librium and irre-versible states and processes; animal thermobiology.	7-8	8	2		2		4						
Together accord-ing to content module 1	50		8	8	8		26						

Content module 2. Electricity. Magnetism. Optics.													
Topic 1. Electricity, bioelectricity.	9-10	14	2	2	2		6						
Topic 2. Magnetism, biomagnetism.	11-12	14	2		4		6						
Topic 3. Geometric, wave optics.	13-14	14	2	2	2		5						
Topic 4. Physiological optics and photobiology of agricultural animals.	15	7	1	2			2						
Together according to content module 2	40		7	6	8		19						
Total hours	**90**		**15**	**15**	**15**		**45**						
Course project (work) with_____			-	-	-		-		-	-	-		-
Total hours													

3. Lecture topics

№ з/п	Назва теми	Кількість годин
1	Mechanics. Kinematics, dynamics, statics. Elastic properties of bodies. Biomechanics.	2
2	Hydrodynamics. Basics of hemodynamics.	3
3	Acoustics, bioacoustics.	1
4	Thermodynamics of equilibrium and irreversible states and processes; animal thermobiology.	2
5	Electricity, bioelectricity.	2

6	Magnetism, biomagnetism	2
7	Geometric, wave optics.	2
8	Physiological optics and photobiology of agricultural animals	1

4. Practical and Laboratory class topics

№	Topic title	Number of hours
1.	Statistical calculations (error, significant figure, rounding).	2
2.	Determining the acceleration of free fall using a mathematical pendulum	2
3.	Determination of Young's modulus of elastic substances	2
4.	Determination of the moment of inertia of a torsional pendulum.	2
5.	Determination of the rate of sedimentation of bodies and the coefficient of internal friction of a liquid by the Stokes method	2
6.	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.	Determination of the surface tension of a liquid by the droplet separation method.	2
8.	Determination of entropy change during melting of tin.	2
9.	Study of the electrostatic field	2
10.	Determination of the electromotive force of the current source by the compensation method	2
11	Determination of the specific charge of an electron using the magnetron method.	2

12.	Determination of the horizontal induction component of the Earth's magnetic field.	2
13.	Determination of refractive indices using a microscope	2
14.	Determination of the wavelength of light using a diffraction grating	2
15.	Practical work "Verifying Malus's Law."	2

5. Self-study

№	Topic title	Number of hours
1	Processing of lecture material	15
2	Preparation for laboratory classes	15
3	Preparation for practical classes	11
4	Self- work 1 – answers to 10 “exam questions” on the topics of Module 1	2
5	Self- work 2 – answers to 10 “exam questions” on the topics of Module 2	2

6. Methods and means of diagnosing learning outcomes:

– oral or written survey;

– testing;

– defense of laboratory / practical, calculation /;

7. Teaching methods :

– problem-based learning method;

– practice-oriented learning method;

– research-based learning method;

– educational discussions and debates method;

8.Assessment of learning outcomes..

The knowledge of a higher education applicant is assessed on a 100-point scale and is converted into a national assessment in accordance with the current "Regulations on Examinations and Tests at the NULES of Ukraine"

8.1 Distribution of points by types of educational activities

Type of educational activity	Learning outcomes	Evaluation
Module 1. Mechanics. Acoustics. Thermodynamics.		
Statistical calculations (error, significant figure, rounding).	Report	**10**
Determining the acceleration of free fall using a mathematical pendulum	Report	**10**
Determination of Young's modulus of elastic substances	Report	**10**
Test task	Answers to questions	**10**
Determination of the ratio of specific heat capacities C_p/C_V of gas by the method of adiabatic expansion (Clément-Desormes method).	Report	**10**
Determination of the surface tension of a liquid by the droplet separation method.	Report	**10**
Determination of entropy change during melting of tin.	Report	**10**
Determination of the wavelength of light using a diffraction grating	Report	**10**
Modular test 1	Answers to questions	**20**
Total by module 1		**100**
Module 2. Electricity. Magnetism. Optics.		

Study of the electrostatic field	Report	**10**
Determination of the electromotive force of the current source by the compensation method	Report	**10**
Determination of the specific charge of an electron using the magnetron method.	Report	**10**
Determination of the horizontal induction component of the Earth's magnetic field.	Report	**10**
Determination of refractive indices using a microscope	Report	**10**
Determination of the wavelength of light using a diffraction grating	Report	**10**
Practical work "Verifying Malus's Law."	Report	**10**
Modular test 2	Answers to questions	**30**
Total by module 2		**100**
Educational work		**(M1 + M2)/2*0,7 ≤ 70**
Exam		**30**
Total per course		**(Educational work + Exam) ≤ 100**

8.2.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"

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 $\mathbf{R_{dis}}$ (up to 100 points), the rating from the exam $\mathbf{R_{ex}}$(up to 30 points) is added to the rating of a student's academic work $\mathbf{R_{aw}}$ (up to 70 points): $\mathbf{R_{dis} = R_{aw} + R_{ex}}$ **.**

8.3. Evaluation Policy

Deadline and resubmission policy **:**	Papers submitted after the deadline without valid reasons will be given a lower grade. Modules may be retaken with the permission of the lecturer if there are valid reasons (e.g., sick leave).
Academic Integrity Policy:	Cheating during tests and exams is prohibited (including using mobile devices).
Visitation Policy:	Attendance at classes is mandatory. For objective reasons (e.g. illness, international internship), studies may be conducted individually (online upon agreement with the dean of the faculty).

9. 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=3634, 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.

10. Recommended sources of information

1. Посудін Ю.І., Бойко В.В., Годлевська О.О., Залоїло І.А. Біофізика(підручник).- Київ, Ліра-К, 2024
2. Практикум з біофізики: навчальний посібник для вищих навчальних закладів. Ч. І. Біомеханіка / В. В. Бойко, І. А. Залоїло, О. О. Годлевська. - К.: , 2021. - 572 с.
3. V. Boyko, P. Ilyin, O. Godlevska. Physics. Навчальний посібник для студентів, що слухають лекції англійською мовою. Київ, Ліра-К, 2024. -286с.
4. V. Boyko, O. Godlevska, P. Iliin, M. Malyuta. “Physics”. Methodical recommendations for the students, who attend the English-speaking lectures. -2022, 51 стор.
5. Posudin Yuriy. Physics with Fundamentals of Biophysics. - 2d edition. - Kyiv: Printline, 2014.- 209p.
6. Physics\ V. Boyko, O. Godlevska, P.Iliin, M. Malyuta\\ Methodical recommendations for the students, who attend the English-speaking lectures, printed NULE of Ukraine, Kyiv. 2021.- 52p.
6. Посудін Ю.І. Лабораторний практикум з дисципліни «Фізика з основами біофізики» для студентів, що слухають лекції англійською мовою. К: 2010.-194 с. (для англомовних груп)
7. 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.
8. Практикум з біофізики : навчальний посібник для вищих навчальних закладів. Ч. ІІ. Біотермодинаміка. Біоелектрика та біомагнетизм. Фотобіологія. / В. В. Бойко, І. А. Залоїло, Ю.І. Посудін. - К.:, 2019. - 486 с.
9. Посудін Ю.І. Фізика з основами біофізики. Київ: Світ, 2003.-400 с.
10. Бойко В.В., Відьмаченко А.П., Ільїн П.П., Гуменюк Я.О., Чорній В.П., Малюта М.В. Методичні вказівки до виконання лабораторних робіт з фізики. Частина 1. // К: Видавничий центр НУБіП України. 2017. -86 с.
11. Бойко В.В., Відьмаченко А.П., Ільїн П.П., Гуменюк Я.О., Чорній В.П., Малюта М.В. Методичні вказівки до виконання лабораторних робіт з фізики. Частина 2. // К: Видавничий центр НУБіП України. 2017. -72 с.
12. Бойко В.В., Відьмаченко А.П., Ільїн П.П., Гуменюк Я.О., Чорній В.П., Малюта М.В. Лабораторні роботи з фізики. Основи теорії та опис лабораторних робіт (односеместровий курс) // К: Видавничий центр НУБіП України. 2017. -195 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

3. Молекулярна фізика. Початок термодинаміки.
URL: https://www.youtube.com/watch?v=fo2HE2tu_3I

4. Електростатика. Електроємність. Конденсатори.
URL: https://www.youtube.com/watch?v=37E2Gc73HaA

5. Магнетизм. Основи. Електрична і магнітна взаємодії. Індукція магнітного поля.
URL: https://www.youtube.com/watch?v=_jReBOzCFLI

6. Оптика. Основні положення.
URL: https://www.youtube.com/watch?v=v64Vq_k-yHo

7. Портал: Фізика – Вікіпедія
URL: https://uk.wikipedia.org/wiki/Портал:Фізика