



1. General Information	
Faculty	Faculty of Foreign Students
Programme	22 Healthcare, 226 Pharmacy, industrial pharmacy, second (master's) level of higher education, full-time
Academic year	2023-2024
Subject	Modern problems of biophysics, ВБ-1.4 kaf_biophysics@meduniv.lviv.ua
Кафедра (назва, адреса, телефон, e-mail)	кафедра біофізики 79010, м. Львів, вул. Шимзерів, 3а тел. +38 (032) 275-58-76 kaf_biophysics@meduniv.lviv.ua
Department	Biophysics Department 70010, Lviv, 3a Shymzeriv +38 (032) 2-75-58-76 Kaf_biophysics@meduniv.lviv.ua
Head of the Department	Roman Fafula, Professor, Doctor of Biological Science Kaf_biophysics@meduniv.lviv.ua
Semester	II
Type of the Subject	optional
Lecturer	Roman Fafula, Prof., Doc.Biol. Sci.; fafula_roman@meduniv.lviv.ua Maria VISTAK, Prof., Doc.Tech. Sci.; vistak_maria@ukr.net Maianna PAYKUSH, Assoc. Prof., Doc. Pedagog. Sci.; marianna.gron@gmail.com Zoryana FEDOROVYCH, Assoc. Prof., PhD in Biology; Zoryana.Ivanytska@gmail.com Oksana MALANCHUK, Assoc. Prof., PhD in Phys. and Math Sci; oksana.malan@gmail.com Lesya TURYANSKA, Senior Teacher, PhD in Phys. And Math Sci.; turyanska_lesya@ukr.net Mariana DRACHUK, Senior Teacher, PhD in Pedagog. Sci.; maryashka0503@gmail.com Galyna GALYK Senior Teacher; galynagalyk@ukr.net
Erasmus	-
Responsible for Syllabus	Maianna PAYKUSH, marianna.gron@gmail.com
Credits ECTS	3 credits
Hours	Lectures – 10 h Laboratory and practical classes – 20 h Individual student's work – 60 h
Language of Instruction	English
Consultations	According to the schedule
Address, telephone number and work schedule of the clinical base, office	-

2. Brief review of the subject (Annotation)

The study of the discipline "Modern problems of biophysics" by students is the result of assimilation of specially selected knowledge, abilities, skills and values necessary for the successful implementation of professional activities. Basic knowledge of this discipline complements the basic discipline "Biological physics with physical methods of analysis" and is an important component of the professional training of future pharmacists.

Physical methods of analysis, which are considered by the discipline, are based on physical laws, phenomena and are widely used by modern pharmaceutical sciences: to establish optimal parameters of technological processes; during the development of new technologies; for the creation of new materials and their improvement in various areas of the pharmaceutical industry.

Modern problems of biophysics include a number of research methods of structure, composition, and properties of substances, as well as the physicochemical processes that occur in them, with the aim of identifying them and creating new substances with given properties, providing an opportunity to obtain the values of various characteristics of the properties of substances.

The content of the discipline "Modern problems of biophysics" has two main features:

1) a more developed scientific apparatus of relevant theories, as well as methods and means of experimental research, the main purpose of which is the development of methods for solving problems with direct access to practice;

2) a specific worldview component, which is based on a general and more visual picture of nature, which contributes to a person's understanding of the modern world and the place it occupies in it.

Consider that the pharmacist's professional activity is integrative in nature, the formation of the content of the discipline was implemented at several levels: the selection of educational material to identify opportunities for integration in the scientific training of future pharmacists; structuring the content based on an integrative approach and professional orientation on pharmaceutical knowledge and skills.

According to the curriculum, optional discipline "Modern problems of biophysics" is studied in the first year of study. The program is structured into 3 content modules, which consist of 8 topics, respectively.

3. Aim of the Subject

The goal of studying the optional discipline "Modern problems of biophysics" is the formation of students' knowledge system about modern problems and scientific directions in pharmaceutical technology, which are based on the laws and phenomena of physics, assimilation of the main tasks, problems and achievements of the main directions of modern biophysics, as well as the analysis of perspectives its development.

The main **tasks** of studying the discipline "Modern problems of biophysics" are:

- ✓ mastering by students of the basic principles and theoretical positions of biophysics;
- ✓ explanation of the relationship between physical and biological aspects of the functioning of living systems;
- ✓ study of biophysical problems related to the physical mechanisms of interactions underlying methods of substance research in pharmacy;
- ✓ research of mechanisms of energy transformation in biological systems, electronic-conformational interactions in biomacromolecules, regulation and self-organization of complex biological systems;
- ✓ interpretation of the influence of environmental factors on the human body.

Achieving these goals will allow future pharmacists to set basic ideas of the most general properties and forms of movement of matter, about the most fundamental physical laws underlying the properties of cells and macromolecules, about physical phenomena that have become the basis of a number of research methods in pharmacy. This will create a foundation for the study of professional disciplines and contribute to their deeper assimilation, as well as ensure the formation of general and special (professional) competencies and learning outcomes, in particular:

General competences (GK):

GK01. Ability to abstract thinking, analysis and synthesis.

GK 05. Ability to evaluate and ensure the quality of the work performed.

GK 06. Teamwork skills.

GK 09. Ability to use information and communication technology.

Special (professional) competences (PC):

PC01. Ability to integrate knowledge and solve complex pharmacy or/ and industrial pharmacy problems in broad or multidisciplinary contexts.

PC03. Ability to solve problems in the pharmacy in new or unfamiliar environments in the presence of incomplete or limited information, consider aspects of social and ethical responsibility.

PC08. The ability to provide rational use and consulting regarding prescription and non-prescription drugs and other products of the pharmacy assortment, pharmaceutical care during the selection and sale of drugs by assessing the risk/benefit ratio, compatibility, consider their biopharmaceutical, pharmacokinetic, pharmacodynamic, and physicochemical, and chemical features, indications/contraindications for use, guided by data on the health status in a given patient.

PC20. The ability to develop and evaluate methods of quality control of medicinal products, including active pharmaceutical ingredients, herbal raw materials and auxiliary substances using physical, chemical, physico-chemical, biological, microbiological and pharmaco-technological control methods.

Program results outcomes (PLO):

PRO01. Possess specialized conceptual knowledge in the field of pharmacy and related fields, consider modern scientific achievements, and be able to apply them in professional activities.(GC01, GC09, PC01, PC03, PC08)

PRO03. Possess specialized knowledge and abilities/skills for solving professional problems and tasks, including for the purpose of improving knowledge and procedures in pharmacy. (GC01, PC01, PC03, PC08)

PRO06. Develop and make effective decisions of solving difficult/complex problems of pharmacy personally and based on the results of joint discussion; formulate the goals of one's own activity and the activity of the team, consider social interest and industrial interests, the general strategy and existing limitations, determine the optimal ways to achieve goals. (GC01, GC06, PC01, PC03)

PRO07. Analyze the necessary information on the development and manufacture of human medicinal products, using professional literature, patents, databases and other sources; systematize, analyze and evaluate it, in particular, using statistical analysis. (GC01, GC09, PC01, PC03, PC08)

PRO08. Develop and implement innovation in the pharmacy field, as well as related interdisciplinary projects with technical, social, economic, ethical, legal and environmental aspects. (GC01, GC09, PC01, PC03, PC08, PC20)

PRO09. Formulate, argue, clearly and concretely convey to specialists and non-specialists, including those seeking higher education, information based on own knowledge and professional experience, the major trends in the pharmaceutical industry and related industries.(GC01, GC06, PC01, PC03)

PRO13. Record cases of side effects when using medicinal products of natural substances and synthetic substances; evaluate factors that can affect the processes of absorption, distribution, deposition, metabolism and elimination of drugs and are determined by the condition and characteristics of the human body and characteristics of pharmaceuticals.(PC08)

PRO15. Predict and determine the influence of environmental factors on the quality and characteristics of medicines and other products of the pharmacy assortment, organize their storage in accordance with their physical and chemical properties and the rules of Good Storage Practices. (GC05, PC08)

PRO19. Develop technological documentation for the manufacture of medicinal products, choose a rational technology, manufacture medicinal products in various dosage forms according to the prescriptions of doctors and the requirements (orders) of medical and preventive institutions, prepare them for release. (GC05, PC08)

PRO22. Ensure and implement quality control of medicinal products and document results; issue quality certificates and analysis certificates taking into account the requirements of the current edition of the State Pharmacopoeia of Ukraine, quality control methods, technological

instructions, etc.; take measures to prevent the distribution of low-quality, falsified and unregistered medicinal products. (GC05, PC08, PC20)

PRO23. Determine the main chemical and pharmaceutical characteristics of medicinal products; choose and/or develop quality control methods with the aim of their standardization using physical, chemical, physico-chemical, biological, microbiological and pharmacotechnological methods in accordance with current requirements. (GC05, PC08)

PRO27. To contribute to the preservation of health, in particular the prevention of diseases, the rational prescription and use of medicinal products. (GC05, PC08, PC20)

4. Preliminary requirements

1. Knowledge of basic concepts, laws, the essence of phenomena, units of measurement for a school physics course.
2. Knowledge of human anatomy from a secondary school biology course.
3. Knowledge of the electronic structure of an atom and the nature of chemical bonds from a school chemistry course.
4. The ability to think abstractly, analyze and synthesize knowledge.
5. Ability to apply knowledge in practical activities.
6. Ability to search, process and analyze information from various sources.

5. Results of the Course

Results

Code	Results	Matrix of competencies
<i>Kn -1</i>	✓ the general physical and biophysical patterns that underlie the functioning of the human body;	PRO 01, PRO 03, PRO 07, PRO 09, PRO 15, PRO 27.
<i>Kn -2</i>	✓ theoretical basis of physical methods of researching medicinal substances, principles of the structure and operation of the corresponding equipment;	PRO 01, PRO 03, PRO 07, PRO 09, PRO 23.
<i>Kn -3</i>	✓ scope of application of learned methods;	PRO 22, PRO 23, PRO 08; PRO 19
<i>Kn -4</i>	✓ physical basis and biophysical mechanisms of action of external factors on human body systems.	PRO 03, PRO 09, PRO 13, PRO 15, PRO 27.
<i>Sk -1</i>	✓ analyze physical processes in the body, using physical laws and phenomena;	PRO 09, PRO 13, PRO 15, PRO 27.
<i>Sk -2</i>	✓ choose appropriate physical methods research to solve specific problems of pharmaceutical analysis;	PRO 01, PRO 03, PRO 06, PRO 07, PRO 08, PRO 19.
<i>Sk -3</i>	✓ use the equipment for conducting physical examinations of medicinal products;	PRO 01, PRO 03, PRO 07, PRO 15.
<i>Sk -4</i>	✓ interpret physical results experiments.	PRO 01, PRO 03, PRO 07, PRO 09, PRO 19.
<i>C -1</i>	✓ ability to apply knowledge in practical situations;	PRO 01, PRO 03, PRO 06, PRO 08 .
<i>C -2</i>	✓ the ability to conduct research on corresponding level.	PRO 19, PRO 22, PRO 23.
<i>AR -1</i>	✓ experience of an independent subject activities - educational and cognitive, analytical, the ability to synthesize knowledge;	PRO 06, PRO 07, PRO 08, PRO 13.
<i>AR -2</i>	✓ ability to self-study and continue professional development;	PRO 09, PRO 15.
<i>AR -3</i>	✓ ability to control, self-control learning outcomes.	PRO 07, PRO 22.

6. Course content				
Course		Full-time form of education		
Classes		Hours	Groups	
Lectures		10		
Practical		20		
Seminars		60		
7. Course content				
Code	Topic	Content	Code	Professors
L-1	Physical foundations of the structure and functioning of macromolecules.	molecular weight, structure, flexibility. Internal rotation and rotational isometry. Conformations of macromolecules. Forces stabilizing the spatial structure of macromolecules. Viscosity of macromolecule solutions. Diffusion of macromolecules. Interaction between macromolecules in solution	<i>Kn -1</i>	Zoryana FEDOROVYCH, Assoc. Prof., PhD in Biology
P-1	Structure and physical properties of macromolecules.	linear chain structure, model of macromolecules, their flexibility, physical states, mechanical properties of polymers, anisotropy of properties, viscosity; orientational displacement	<i>Kn -1</i> <i>Sk -1</i>	According to the schedule
ISW-1	Diffusion of macromolecules. Interaction between macromolecules in solution.	conformations of low-molecular compounds, the possibility of forming and changing conformations, the energetic aspect of conformational transformations	<i>Kn -1</i> <i>Sk -1</i>	According to the schedule
P-2	Interaction between macromolecules in solution.	properties of solutions of high molecular weight compounds, diffusion of solvent molecules, formation of homogeneous systems	<i>Kn -1</i> <i>Sk -1</i>	According to the schedule
ISW-2	Effect of temperature on the rate of biochemical reactions.	the rate of a chemical reaction and methods of its determination, the Van't Hoff isotherm equation of a chemical reaction and its analysis, the dependence of the equilibrium constant on temperature	<i>Kn -1</i>	According to the schedule

P-3	Biophysics of proteins and physical methods of their research.	primary and secondary structure of proteins; optical rotation dispersion, absorption and differential spectrophotometry of proteins, fluorescence spectroscopy of proteins, NMR and EPR methods	<i>Kn -1</i> <i>Sk -1</i> <i>AR-1</i>	According to the schedule
ISW-3	Biotechnological methods of obtaining proteins.	the main directions of the development of biotechnology in the protein preparations production; protein biosynthesis and its regulation	<i>Kn -1</i> <i>Sk -1</i>	According to the schedule
P-4	Biophysics of nucleic acids.	primary structure of nucleic acids; DNA conformation	<i>Kn -1</i> <i>Sk -1</i>	According to the schedule
ISW-4	Optical characteristics of nucleic acids.	UV absorption, denaturation, hyperchromic effect, DNA melting curve, melting temperature	<i>Kn -1</i> <i>Sk -1</i>	According to the schedule
L-2	Physical foundations of studying the structure, functions of cells and intercellular interactions.	dynamic pores and mechanisms of their formation; mechanism of action of biologically active compounds on ion channels; physical and chemical characteristics of the cell surface, methods of their study; cellular contacts: types, electrical properties, mechanical strength. Methods of studying cell adhesion	<i>Kn -1</i> <i>Kn -3</i>	Zoryana FEDOROVYC H, Assoc. Prof., PhD in Biology
P -5	Physical properties of cells. Pores in biomembranes. Biophysics of intercellular interactions.	mechanical and electrical properties of cells, methods of estimating effective pore size; types of cellular contacts and their properties	<i>Kn -1</i> <i>Sk -1</i>	According to the schedule
ISW-5	Functional systems of the cell, their importance for maintaining cell viability. Molecular principles of cellular reactivity.	the relationship between pathological changes on the cellular level and organism level of organization; damaging factors: temperature, visible, UV and ionizing radiation, chemical compounds, changes in the ionic composition of the environment, pH, osmotic pressure	<i>Kn -1</i> <i>Sk -1</i>	According to the schedule

ISW-6	Methods of studying cell adhesion. Modeling of intercellular contacts. The mechanism of disruption of intercellular interactions in pathology.	adhesion molecules during cell adhesion, transmembrane adhesion molecules during information exchange; intercellular interactions in the myocardium and the nervous system	<i>Kn</i> -1 <i>Kn</i> -3 <i>Sk</i> -1	According to the schedule
L-3	Modern research technologies of biomacromolecules.	study of the characteristics of macromolecules and their conformational mobility	<i>Kn</i> -3 <i>Sk</i> -2	Zoryana FEDOROVYC H, Assoc. Prof., PhD in Biology
P-6	Methods of determining mass, shape and size of biomolecules and their conformational mobility.	osmometry, viscometry, electrophoresis of macromolecules, ultracentrifugation, birefringence, quasi-elastic scattering of light; adsorption spectroscopy in the UV and visible region, calorimetry	<i>Kn</i> -3 <i>Sk</i> -2 <i>Sk</i> -3	According to the schedule
ISW-7	Methods of studying vibrational spectra of macromolecules.	Raman scattering, infrared spectroscopy, fluorescence spectroscopy, dielectric spectroscopy	<i>Kn</i> -1 <i>Sk</i> -2 <i>Sk</i> -3	According to the schedule
ISW-8	Methods of determining the structure of biomolecules in solid samples.	electron microscope, nuclear magnetic resonance, atomic force microscopy, X-ray structural analysis	<i>Kn</i> -1 <i>Sk</i> -2 <i>Sk</i> -4	According to the schedule
P-7	Ultrasound research methods in pharmacy.	intensification of drug preparation processes: acceleration of the dissolution of medicinal substances by ultrasound; ultrasound extraction and dispersion; production of aerosols, emulsions and suspensions using ultrasound	<i>Kn</i> -2 <i>Sk</i> -3 <i>Sk</i> -4	According to the schedule
ISW-9	The principle of ultrasonic cleaning of surfaces.	effects: cavitation, acoustic flows, sound pressure and sound capillary effect; the main types of impurities that are removed in the process of ultrasonic cleaning; ultrasound cleaning technology	<i>Kn</i> -2 <i>Sk</i> -3 <i>Sk</i> -4	According to the schedule
P-8	Physical foundations of electron microscopy. Application of modern electron microscopes in pharmacy and medicine.	the principle of operation of the electron microscope; the main types of electron microscopes: transmission, emission, reflection, raster	<i>Kn</i> -2 <i>Sk</i> -2 <i>Sk</i> -3	According to the schedule
ISW-10	Modern methods of electron microscopy.	chemical or physical fixation of tissues and	<i>Kn</i> -2 <i>Kn</i> -3	According to the schedule

		microorganisms; freezing/chilling and freezing/thawing methods	<i>Sk -2</i>	
L-4	Spectral methods of analysis in drug research.	adsorption spectroscopy, dispersion of optical rotation	<i>Kn -2</i>	Zoryana FEDOROVYC H, Assoc. Prof., PhD in Biology
P-9	Absorption spectroscopy. Dispersion of optical rotation.	general theory of light absorption by atoms and molecules; spectrophotometer structure; application of absorption spectroscopy in the visible and UV regions of the spectrum; theory of DOR and CD; equipment for measuring DOR and CD; DOR and CD application	<i>Kn -2</i> <i>Kn -3</i> <i>Sk -2</i> <i>Sk -4</i>	According to the schedule
ISW-11	Fluorescence spectroscopy and its use for the study of proteins.	fluorescence theory; spectrofluorimeter scheme; fluorescence polarization; method of fluorescent labels and its application	<i>Kn -2</i>	According to the schedule
L-5	The influence of physical characteristics of the environment on human health.	influence of mechanical environmental factors; interaction of electromagnetic fields with biological structures	<i>Kn -4</i>	Zoryana FEDOROVYC H, Assoc. Prof., PhD in Biology
P-10	The influence of low and high temperatures on biological objects.	physical properties of water and aqueous solutions at low temperatures; behavior of proteins at low temperatures	<i>Kn -4</i> <i>Sk -1</i>	According to the schedule
ISW-12	The influence of atmospheric pressure and humidity on the human body.	the effect of atmospheric pressure on baroreceptors of blood vessels, the inner surface of joint capsules; the influence of humidity on the processes of thermoregulation	<i>Kn -4</i> <i>Sk -1</i>	According to the schedule
ISW-13	Positive and negative consequences of the interaction of ultraviolet radiation with a biological object.	UV absorption by bioobjects; bactericidal effect of UV radiation; erythema, skin burn, eye damage	<i>Kn -4</i> <i>Sk -1</i>	According to the schedule
ISW-14	Earth's magnetic field and its influence on man.	characteristics of the Earth's MF; impact on the body; use in medicine	<i>Kn -4</i> <i>Sk -1</i>	According to the schedule
ISW-15	Biophysical methods in valeurology and sports medicine.	the physiological effect of massage on the human body and the mechanism of action of healing factors; movement and energy	<i>Kn -4</i> <i>Sk -1</i>	According to the schedule

		consumption; breathing exercises		
ISW-16	Biophysics of space medicine.	knowledge about the impact of gravitation on biological object, the influence of microgravity on living systems at the cellular and molecular levels of organization; risks from cosmic radiation	Kn -4 Sk -1	According to the schedule

The structure of the practical classes includes preliminary control of students' knowledge and skills; formulation of the general problem and its discussion with the participation of students, solving problems with medical and biological content and current control.

Teaching techniques are used for conducting practical classes: diagnosis (conversation, observation, testing); informing (demonstration, counseling, story, problem statement, test control); independent work (research of scientific and information sources; creation of presentations); practical work (solving problems).

The following interactive learning technologies are used for their implementation: case method, team learning, analysis of situational problems with content close to professional activity, discussions, multimedia presentations.

8. Verification of results

Current control

It is carried out during training sessions in accordance with specific goals and aims to check the assimilation of educational material. During the assessment of learning outcomes, the following control methods are usually used: oral communication, testing, structured written works. Forms of assessment of current educational activities are standardized and include control of theoretical training. The final grade for the current educational activity is given on a 4-point (national) scale.

Evaluation criteria

Evaluation on a 4-point scale	Evaluation criteria for structured written work	Evaluation criteria for test control on the MISA platform (15 questions with one correct answer)
«5»	<i>The student has mastered the theoretical material flawlessly, demonstrates deep and comprehensive knowledge of the relevant topic or academic discipline, the main provisions of scientific primary sources and recommended literature, thinks logically and constructs an answer, freely uses acquired theoretical knowledge at analysis of practical material, expresses your attitude to certain problems, demonstrates a high level of assimilation practical skills.</i>	90-100 points
«4»	<i>The student has mastered the theoretical material well, possesses the main aspects from primary sources and recommended literature, presents it in a reasoned way; owns practical skills, expresses his thoughts on certain problems, but assumes certain inaccuracies and errors in the logic of the presentation of the theoretical content or when performing practical skills.</i>	70-89,9 points
«3»	<i>student mainly mastered the theoretical knowledge of an educational topic or discipline, orients itself in primary sources and recommended literature, but answers</i>	50-69,9

	<i>unconvincingly, confuses concepts, additional questions arise from the student uncertainty or lack of stable knowledge; answering questions of a practical nature, reveals inaccuracies in knowledge, does not know how to evaluate facts and phenomena, relate them to future activities, execution errors are assumed practical skills.</i>	
«2»	<i>The student has not mastered the study material topics (disciplines), does not know scientific facts, definitions, almost does not focus on primary sources and recommended literature, lack of scientific thinking, practical skills are not formed.</i>	<i>Less than 50 points</i>

Learning outcome code	Code of the type of classes	Method of verification of learning outcomes	Enrollment criteria
<i>Kn-1 Sk-1</i>	<i>P-1 ISW -1</i>	<i>written control, which includes extensive theoretical questions</i>	evaluation according to the established criteria on a traditional 4-point scale
<i>Kn-1 Sk-1</i>	<i>P-2 ISW-2</i>	<i>written control, which includes extensive theoretical questions</i>	evaluation according to the established criteria on a traditional 4-point scale
<i>Kn-1 Sk-1 AR-1</i>	<i>P-3 ISW-3</i>	<i>written control, which includes extensive theoretical questions</i>	evaluation according to the established criteria on a traditional 4-point scale
<i>Kn-1 Sk-1</i>	<i>P-4 ISW-4</i>	<i>written control, which includes extensive theoretical questions</i>	evaluation according to the established criteria on a traditional 4-point scale
<i>Kn-1 Kn-3 Sk-1</i>	<i>P-5 ISW-5 ISW-6</i>	<i>written control, which includes extensive theoretical questions</i>	evaluation according to the established criteria on a traditional 4-point scale
<i>Kn-3 Sk-2 Sk-3 Sk-4</i>	<i>P-6 ISW-7 ISW-8</i>	<i>written control, which includes extensive theoretical questions</i>	evaluation according to the established criteria on a traditional 4-point scale
<i>Kn-2 Sk-3 Sk-4</i>	<i>P-7 ISW-9</i>	<i>written control, which includes extensive theoretical questions</i>	evaluation according to the established criteria on a traditional 4-point scale
<i>Kn-2 Sk-2 Sk-3</i>	<i>P-8 ISW-10</i>	<i>written control, which includes extensive theoretical questions</i>	evaluation according to the established criteria on a traditional 4-point scale
<i>Kn-2 Kn-3 Sk-2 Sk-4</i>	<i>P-9 ISW-11</i>	<i>written control, which includes extensive theoretical questions</i>	evaluation according to the established criteria on a traditional 4-point scale
<i>Kn-4 Sk -1</i>	<i>P-10 ISW-12 ISW-13 ISW-14 ISW-15 ISW-16</i>	<i>written control, which includes extensive theoretical questions</i>	evaluation according to the established criteria on a traditional 4-point scale

The final test	
General evaluation system	Участь у роботі впродовж семестру за 200-бальною шкалою
Scales	4-point scale, 200-points scale, ECTS
The conditions of access to the final test	The student attended all practical classes and received at least 120 points for the current academic performance.
<p>The form of final control of study success in accordance with the curriculum is the semester credit, which is conducted after the end of the study of the discipline on the basis of grades for current success. The credit is set by teachers who conducted practical (seminar) classes in the study group. Semester assessment does not require students to be present.</p> <p>The maximum number of points that a student can score for the current educational activity while studying the discipline is 200 points.</p> <p>The minimum number of points that a student must score for the current educational activity to enroll in the discipline is 120 points.</p> <p>The calculation of the number of points is carried out on the basis of the grades received by the student on a traditional scale during the study of the discipline during the semester, by calculating the arithmetic average (AA), rounded to two decimal places. The obtained value is converted into points on a multi-point scale as follows:</p> $x = \frac{AA \cdot 200}{5}$	
9. Course policy	
<i>Academic integrity policy – independent performance of educational tasks, tasks of current and final control of learning results.</i>	
10. Literature	
<p>1. Basic:</p> <ol style="list-style-type: none"> Chalyi A.V., Tsekhmister Ya.V., Agapov B.T. Medical and Biological Physics: textbook for the students of higher medical institutions of the IV accreditation level. / A.V. Chalyi, Ya.V. Tsekhmister, B.T. Agapov – Vinnytsia, Nova Knyha, 2010. – 480 p. Hobie R.K., Roth B.J. Intermediate Physics for Medicine and Biology. / R.K. Hobie, B.J. Roth. – Springer, 2007. – 616 p. Medical and Biological Physics: Laboratory Manual for students of higher medical institutions of the IV accreditation level // Lychkovsky E., Fafula R., Fedorovych Z., Makar N., Odnorih L. – Lviv, Danylo Halytsky Lviv National Medical University, 2014. – 300 p. Cotterill R. Biophysics. An introduction. J. Wiley & Sons, 2002. – 396 p. Davidovits P. Physics in biology and medicine. 5-th ed. – Amsterdam: Elsevier Academic Press, 2019. – 377 p. <p>2. Additional:</p> <ol style="list-style-type: none"> Medical and biological physics. Practicum for students studying the subject in English / V. M. Trusova et al. - Kharkiv: V. N. Karazin Kharkiv nat. univ., 2018. - 123 p. Newman J. Physics of the Life Sciences. – Springer, 2008. – 718 p. Herman I.P. Physics of the Human Body. – Springer, 2008. – 860 p. Glaser R. Biophysics an introduction. 2-nd ed. – Berlin: Springer, 2012. - 407 p. Hille B. Ionic Channels of Excitable Membranes. Sinauer Associates inc. Sunderland, 2004 - 816 p. 	
11. Equipment, hardware and software resources of the discipline/ course	
<i>a multimedia projector for conducting classes, an Internet network for individual tasks, a misa distance learning platform; thematic plan.</i>	

12. Additional information

Docent Oksana Malanchuk is responsible for the educational process at the department
oksana.malan@gmail.com

A student scientific circle works at the department. The head of the scientific circle is
Maianna PAYKUSH, Assoc. Prof., Doc. Pedagog. Sci.; marianna.gron@gmail.com

Web page of the department: : <https://new.meduniv.lviv.ua/kafedry/kafedra-biofizyky/>

Compiler of Syllabus:

Maianna PAYKUSH,

Assoc. Prof., Doc. Pedagog. Sci

(Signature)

Head of the Department

Roman Fafula,

DSc, Professor

(Signature)