

SYLLABUS

INTERNATIONAL EUROPEAN
UNIVERSITY



SCHOOL OF
MEDICINE

“Medical and Biological Physics”
EPP "Medicine"

2024



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1	Name of the course and educational program
	Medical and Biological Physics. EPP "Medicine"
2	Course description
	The study of objects of living nature requires meaningful knowledge of fundamental physical laws, processes and phenomena that take place in living systems, and affect their vital activity. This is the content and task of the discipline "Medical and Biological Physics", which studies living systems, including the human body, at all levels of their organization on the basis of fundamental physical laws in order to describe and explain specific processes and phenomena inherent in living things (functions of the organism), as well as the mechanisms of influence of factors of physical nature from the surrounding natural and man-made environment. A separate subject of the discipline "Medical and Biological Physics" is the study of the physical foundations of diagnostic, therapeutic and preventive methods of medicine.
3	Background of study
	The study of the discipline "Medical and Biological Physics" is based on previously acquired knowledge of physics, mathematics, chemistry and biology in accordance with the program of secondary school.
4	Amount of credits/hours
	3 ECTS credits / 90 academic hours
5	Training format
	Full-time training
6	Classroom Location
	https://classroom.google.com/c/NzA4MjQ1NTIwMjE4
7	Full name of the teacher
	Taranyuk Gennadiy Petrovych (lectures and practical classes)
8	Pulpit
	Department of Fundamental and Medical-Preventive Disciplines of the Scientific Research Institute "EMS"





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9 Office Location

Kyiv, Akademika Glushkova Ave., 42 V, office. 411

Study room location

Kyiv, Akademika Glushkova Ave., 42 V, office. 405

10 Counseling

Offline/online every Friday from 16:00 to 17:30 with prior registration via corporate mail, etc.

11 Teacher's e-mail

gennadiytaranyuk@ieu.edu.ua

12 Course Objectives

Formation of a holistic complex of general scientific, fundamental physical and biophysical knowledge necessary for understanding medical and biological phenomena and acquiring appropriate professional competencies in the field of practical medicine in future specialists in the field of health care by:

- study of the physical foundations of medical-biological and physiological processes;
- study of the mechanisms of influence of physical environmental factors on the human body;
- study of the physical foundations of diagnostic, therapeutic and preventive methods of medicine, the work of medical equipment.

13 The role of the academic discipline in achieving program results

PLO 2. Evaluate information regarding the diagnosis, applying a standard procedure based on the results of laboratory and instrumental studies.

PLO 14. Determine the source and/or location of the necessary information depending on its type; obtain the necessary information from a certain source; process and analyze the information received.

PLO 16. Prepare an annual report on personal production activities; keep medical records regarding the patient and the population contingent in the state language.

PLO 18. Identify negative environmental factors; analyze the health status of a certain contingent; determine the existence of a connection between the state of the environment and the state of health of a certain contingent; develop preventive measures based on data on the relationship between the state of the environment and the state of health of a certain contingent. To assess the impact of socio-economic and biological determinants on the health of the individual, family, and population.

PLO 25. To organize the necessary level of individual security (own and those of the person he cares for) in the event of typical dangerous situations in the individual field of activity.

PLO 28. To compile an algorithm for biochemical, laboratory-diagnostic and functional examination of the patient depending on the state and stages of the disease, taking into account the main pathological symptoms and syndromes of the disease, analyzing the functional state of organs and systems, depending on the state and stages of the disease.



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Learning outcomes

- Knowledge of physical and biophysical phenomena and patterns of life of wildlife objects and the human body as a whole;
- knowledge of factors and mechanisms of influence on the human body of factors of physical nature;
- knowledge of the physical and technical foundations of diagnostic, therapeutic and preventive methods of medicine;
- possession of skills in working with medical equipment;
- ability to conduct theoretical and practical research on the basis of fundamental medical and biological knowledge and solve typical and specialized complex problems of medical and biological

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Course Content

Topic 1. "Medical and Biological Physics" as an academic discipline. Fundamentals of biomechanics. Topic 2. Fundamentals of Molecular Biophysics and Biological Thermodynamics.

Topic 3. Fundamentals of Biorheology.

Topic 4. Basics of bioacoustics. Biophysics of hearing. Topic 5. Acoustic diagnostic methods.

Topic 6. Physical foundations of hemodynamics. Modeling of blood circulation processes. Measurement and calculation of geodynamic indicators.

Topic 7. Biophysics of membrane processes. Generation and propagation of action potential.

Topic 8. Electrographic diagnostic methods.

Topic 9. Physical foundations and methods of physiotherapy.

Topic 10. Optical methods of medical and biological research and diagnostics.

Topic 11. Physical Foundations of Radiology and Radiation Medicine. Radiation safety.

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Books and materials

1. Medical and Biological Physics. Part I / [V.I. Fediv, O.I. Olar, O.Y. Mykytiuk et al.]. Textbook for students of higher medical educational institutions - Chernivtsi: BSMU Publishing House, 2016.

- 205 p. (Recommended by the State Institution "Central Methodological Cabinet for Higher Medical Education of the Ministry of Health of Ukraine" letter No. 23-01-9/225 dated 05.03.2016, protocol No. 1 dated 24.03.2016).

2. Medical and Biological Physics. Part II / [V.I. Fediv, O.I. Olar, O.Y. Mykytiuk, V.F. Boyechko]. Textbook for students of higher medical educational institutions - Chernivtsi: BSMU Publishing House, 2017. - 235 p. (recommended by the State Institution "Central Methodological Cabinet for Higher Medical Education of the Ministry of Health of Ukraine", letter No. 23-01-9/261 dated 08.06.2017, protocol No. 2 dated 02.06.2017)

3. Medical and Biological Physics. Textbook for students of higher medical educational institutions / V.I. Fediv, O.I. Olar, V.V. Kulchynskiy, G.Y. Rudko. Textbook for students of higher medical educational institutions - Chernivtsi, Bukovyna State Medical University, 2017.-342 p. - English. (recommended by the State Institution "Central Methodological Cabinet for Higher Medical Education of the Ministry of Health of Ukraine", letter No. 23-01-9/258 dated 08.06.2017, protocol No. 2 dated 02.06.2017)

4. Medical and Biological Physics: A Textbook for Students. higher med. (pharmaceuticals) Teaching. institution. / per order. Prof. O. V. Chaly. — View. 2. — Vinnytsia: Nova Kniga, 2017.— 528 p.

5. Medical and Biological Physics. / edited by prof. A.V. Chalyi. – 2nd ed. – Vinnytsia, Nova Knyha, 2013. – 480 p.

6. Biophysics / P.G. Kostyuk (ed.), V.L. Zyma, I.S. Magura, Miroshnichenko M.S., Shuba M.F. – K.: VPC "Kyiv University", 2008.

7. Structure and principles of operation of medical equipment: manual / V.D. Didukh and others. – TSMU. – 2016. – 268 p. (in Ukrainian).

8. Egorenkov A.I., Pashchenko V.V., Lesko L.G. Physical Foundations of Medical and Diagnostic Measurements: A Methodical Guide for Students of Medical Specialties. Kyiv: Kniga Plus, 2023. 76 p.



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Books and materials

9. Biophysics. Physical Methods of Analysis and Metrology: Textbook. / E.I. Lychkovskiy et al. Vinnytsia: New Book, 2014. 464 p. (in Ukrainian).
10. Medical and Biological Physics: Teaching. Manual. / V. P. Martsenyuk et al. — Ternopil: TDMU, 2012. 303 p. (in Ukrainian).
11. Grigoryeva L.I., Tomilin Yu.A. Fundamentals of Biophysics and Biomechanics: Teaching. Manual. Mykolaiv: Vyd-vo Chornomorskogo gosudarstvennogo universitet. P. Mohyli, 2011. 300 p. (in Ukrainian).
12. V.L. Winter Biophysics. Collection of problems. Kyiv: Vyshcha shkola, 2001.
13. Irving P. Herman. Physics of the Human Body. Berlin, Heidelberg: Springer – Verlag. 2007, 783 p.
14. Medical and Biological Physics. MODULE 1. Mathematical processing of medical and biological data. Basic of regularities of biomechanics and electricity and their use for diagnosis and treatment. Educational-methodical textbook / ed. by V.I. Fediv // Chernivtsi, Higher State Educational Establishment of Ukraine "Bukovinian State Medical University", 2019. - 146 pp.
15. Medical and Biological Physics. MODULE 2. Basic concepts and laws of electromagnetism, optics, quantum and nuclear physics. Educational-methodical textbook / ed. by V.I. Fediv // Chernivtsi, Bukovinian State Medical University, 2020. - 151pp.
16. Y. Lopushansky. Collection of problems and questions in medical and biological physics. Lviv, Taras Shevchenko Scientific Society, 2006.
17. Ministry of Education and Science of Ukraine <http://www.mon.gov.ua/>
- National Library of Ukraine. V.I. Vernadsky <http://www.nbuv.gov.ua/>
18. Internet resources on higher mathematics, medical and biological physics.
19. Medical and Biological Physics: A Textbook for Students. higher med. (pharmaceuticals) Teaching. institution. / per order. Prof. O. V. Chaly. — View. 2. Vinnytsia: New Book, 2017. 528 p. URL:
20. <https://studfile.net/preview/1902522/page:132/>
21. Biophysics.URL: . <https://en.wikipedia.org/wiki/Biophysics>
22. <https://onlinelibrary.ieu.edu.ua/medicine/>

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Technical requirements for working on the course

To work on the course of the discipline "Medical and Biological Physics", you need regular access to a computer (or phone) and the Internet.

To successfully study and pass the exam in the discipline, you need to familiarize yourself with the remote platform (Moodle or Classroom) and study all the folders on which there is already or staged information or materials for studying the course. You will also need to upload and create documents, watch videos, or create one.

The ability to use remote platforms is possible only if you have corporate mail.

If it is impossible to enter the course, you need to inform the dean's office, or the headman, or directly the course teacher.

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Learning process

The process of studying the discipline "Medical and Biological Physics" consists of lectures, practical classes and independent work of higher education applicants.

1. Lectures are conducted using such forms and methods of teaching as lecture, lecture-conversation, discussion, discussion of problematic issues, demonstration, analysis of problem situations in accordance with the topic of the lesson.

2. Practical classes include conducting practice-oriented educational and scientific-scientific work using devices, materials and equipment for laboratory, diagnostic and demonstration purposes and simulation technologies, solving analytical-calculation and qualitative problems, performing individual and group (team) tasks, listening to and discussing reports, surveys, testing.



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18 Learning process

Lectures and practical classes are conducted using explanatory-illustrative, reproductive, problem-based, heuristic, research, interactive, dual, and transdisciplinary teaching methods.

3. Independent work is an individual and group educational activity of higher education applicants outside of lectures and practical classes and includes:

- elaboration of educational material;
- performance of individual tasks in the form of a problem question, test, qualitative or calculation task;
- preparation of reports, writing essays;
- implementation of project educational and scientific research work;
- consulting with the teacher;
- preparation for the final control of knowledge.

Independent work is carried out using problem, heuristic and research teaching methods.

19 Signs of discipline

Term of teaching	Semester	International Disciplinary Integration	Course year (training)	Cycles: General Training/ Professional Training/ Free Choice
1 semester = 16 weeks	1st	yes	1st	General training cycle

20 Grading Policy

Assessment of initial performance in the discipline "Medical and Biological Physics" consists of two components: assessment of current performance and assessment based on the results of the final control of knowledge, which is carried out in the form of a differentiated test.

Assessment of current academic performance is carried out by calculating the arithmetic mean of grades for all topics of the discipline provided for by the program (11 topics - 11 thematic assessments) on a 4-point scale ("2", "3", "4", "5"), followed by conversion on a 120-point scale into a rating point of current academic performance (final score of current academic performance). 120 points corresponds to an average thematic score of "5". So, on this scale, the conversion factor is: $120/5 = 24$. Accordingly, the rating score is calculated as the product of the arithmetic mean thematic score by the conversion factor "24" and is rounded to the integer number of rating points:

Rating score = arithmetic mean thematic $\times$ 24.

For example, if the arithmetic mean of the topic is 3.00 points, then the rating score is $3.00 \times 24 = 72$, if the average score is 3.62, then respectively $3.62 \times 24 = 86.88 \approx 87$ according to the rules of approximate calculations.

In turn, the assessment for each topic is a generalized average of grades for individual types of educational activities within this topic, namely:

- activity during the practical lesson;
- performing an individual/group task in a practical lesson and/or extracurricular independent work (homework);
- surveys/testing;



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Grading Policy

- writing an essay;
- oral report (presentation).

The minimum rating level of current academic performance required for admission to the final control of knowledge is 72 points.

Assessment based on the results of the final control of knowledge (differentiated credit) is carried out on a 4-point scale ("2", "3", "4", "5") and is converted into an 80-point scale with a conversion coefficient of "16": "5" - 80 points ($80 = 5 \times 16$), "4" - 64 points, "3" - 48 points. A grade of "2" is counted as 0 points.

The assessment of the final control of knowledge on a 4-point scale is calculated as the weighted average of grades for each task in the following respect: correctly solved problem - 50% of the maximum grade, correct answer to each of the two theoretical questions - 25% of the maximum grade. The maximum number of points that a student can score during the final control is 80. The final control is considered to be credited if the student has scored at least 60% of the maximum amount of points for the final control, i.e. 48 points.

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Grading scale

The grade for the discipline is determined as the sum of the final score for the current performance and the point for the final control in the form of a differentiated test, and is expressed on a 200-point scale. The total final score in the discipline is 200. For example, if the rating score of the current performance is 90, and the final control of knowledge is 64, then the initial rating score is: $90 + 64 = 154$ points.

The final assessment of academic performance in the discipline is set according to the national and European assessment scale.

Sum of points for all types of learning activities	ECTS assess ment	National scale score	
		for an exam, course project (work), practice	For the sake of credit
180 - 200	And	Perfectly	Credited
170 - 179	Into	well	
160 - 169	C		
140 - 159	D	Satisfactory	
120 - 139	E		
100 - 119	FX	unsatisfactory with the possibility of reassembly	not credited with the possibility of retaking
1 - 99	F	unsatisfactory with the obligatory re-study of the discipline	not enrolled with mandatory re-study of the discipline



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22 How to find out your score

To check your grades for assignments and read the teacher's comments, you should check the relevant tabs of the Moodle or Classroom distance learning platforms.

You can also get information about the grades received directly from the course teacher through corporate mail or by appointment on the days of consultations (room 405).

23 Course Policy

The study of the discipline "Medical and Biological Physics" involves compliance with the rules that ensure effective mastery of the subject, both in theory and in practice, namely:

- regular, without skipping, attendance of lectures and practical classes;
- stay of the teacher and students in the class in accordance with the schedule and the established time schedule of classes;
- the presence of the teacher and students in classes neatly dressed in appropriate clothes, namely a white coat;
- full presentation of the training course by the teacher in accordance with the program of the academic discipline;
- keeping notes of lectures and notes on practical classes by the student;
- The study of the discipline takes place on the basis of collegiality, cooperation and solidarity of the teacher and students;
- discussion of educational issues takes place in the form of a discussion between the teacher and students, and students among themselves;
- conducting lectures and practical classes, with the exception of the final control of knowledge, provides for independent work of students using information technologies and means of processing, storing and transmitting information, including computers, personal gadgets and other electronic devices, as well as textbooks, manuals, methodological developments, etc.;
- Scientific search and research work of students is welcome
- a component of training is writing essays on topics specified in the list of mandatory tasks;
- Writing essays from the list of topics of elective tasks is desirable and mandatory if the student wants to improve his grade;
- topics of the discipline are considered from the point of view of their practical application and bioethical capacity;
- The mutual behavior of the teacher and students, and students among themselves in classroom and extracurricular time corresponds to generally accepted norms and role models of behavior that imply mutual respect and collegial nature of relationships and exclude religious, racial, ethnic, cultural, age, gender, social, political, and other prejudices and prejudices, as well as bullying, sexual harassment, and other manifestations and forms of intolerance and humiliation of human dignity
- Any manifestations of corruption in the educational process, both on the part of the teacher and on the part of students, are unacceptable

All participants in the educational process are guided by the principles of academic integrity.

24 Completing the task late, correcting grades, working out

Assignments must be submitted via Moodle or Classroom by the completion dates specified in the course schedule on our website. Most of the tasks must be completed by 09:00 on the day of the next lesson in order to align them with the content of the course and activities in the group. It is best practice to complete the assignment as soon as possible after receiving it so that you have enough time to actively participate in the class.

If you need more time to complete a task, flexible deadlines are available. Completed tasks are accepted for full credit until the last lesson in the discipline according to the schedule, after which 40%



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24 Completing the task late, correcting grades, working out

Partial credit based on the grade received will be credited within a week after the last day of classes. Tasks that did not pass at all will receive 0.

If you plan to miss classes for more than one week due to illness or other reasons, please contact your instructor to arrange alternative assignment options.

25 Teacher's response time

Through corporate mail, within 24 hours.

26 Effective communication

The main recommendations for effective communication are a corporate email directly with the course teacher; this is personal communication with classmates through social networks/corporate mails/mobile phones; this is communication directly on the course of distance platforms Moodle or Classroom; This is a face-to-face meeting with the teacher on the days of consultations.

27 Course Materials Publication and Distribution Policy

Students may not post, publish, sell, or otherwise publicly distribute course materials without the written permission of the instructor.

Such materials include, but are not limited to: lecture notes, lecture slides, video or audio recordings, assignments, problem sets, exams, other students' papers, and answer keys.

Students who sell, post, publish, or distribute course materials without written permission for the purpose of obtaining answers or otherwise may be subject to disciplinary action, up to and including a requirement to opt out. In addition, students may not make video or audio recordings of classes for their own use without written permission from the instructor.

28 Expected workload and student engagement

Separate hours should be allocated for work in this course for independent study of some lecture materials in accordance with the topic of the course (approximately 3-5 hours per week).

If circumstances arise that force you to spend more time on any of the tasks, inform the teacher by e-mail.

An extension of the deadline is possible only if the teacher is informed in advance that you will not be able to submit the assignment on time. Students are expected to have a backup plan in case of computer malfunction or Internet outages.



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Support

Electronic timetable
Library
Curated Repository
Dean's Office

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Course Schedule

Title of the lecture topic	Practical classes
1. Medical and biological physics as an academic discipline. Fundamentals of biomechanics.	1. Determination of the center of gravity of the human body by anthropometric measurements.
2. Fundamentals of molecular biophysics and biological thermodynamics.	2. Study of the phenomena of intermolecular interaction and kinetic processes in biological media.
	3. Determination of the energy balance of the body based on the first law of thermodynamics.
3. Fundamentals of biorheology.	4. Study of the rheological properties of biological tissues.
4. Basics of bioacoustics. Biophysics of hearing.	5. Study of the physical foundations of auditory perception.
	6. Study of the physical foundations of acoustic diagnostic methods.
5. Physical foundations of hemodynamics.	7. Calculation of hemodynamic parameters.
	8. Methods for measuring blood pressure.
6. Biophysics of membrane processes.	9. Study of membrane transport processes.
	10. Modeling and calculation of membrane potentials.
7. Electrographic diagnostic methods.	11. Study of electrographic diagnostic methods.
	12. Study of physical foundations and methods of physiotherapy.
	13. Study of optical methods of medical research and diagnostics.
8. Physical foundations of radiology and radiation medicine. Radiation safety.	14. Radiological methods of medical and biological research.
	15. Interaction of ionizing radiation with biological tissues.
	16. Final control of knowledge.



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Tips for successful study in the course

- ! Attending classes
- ! Dialogue with the teacher on all issues of the curriculum
- ! Perform tasks according to the program
- ! Writing essays on the topics of the program
- ! Discussion of topics and tasks in groups in extracurricular time
- ! Use of Internet resources