Federal State Budget Educational Institution
of Higher Education
Pacific State Medical University
of the Ministry of Health of the Russian Federation

APPROVED BY

Director of the Institute of Fundamentals and
Information Technologies in Medicine
_____ / Bagryantsev V.N./
"4th" of April 2025

SUBJECT GUIDE FOR TEACHERS AND STUDENTS FOR

Б1.О.05 Medical physics

(Name of discipline)

Specialty	**31.05.01 General Medicine for international students (in English)** (code, name)
Degree	Specialist's degree
Profile	02 "Healthcare" (in the field of providing primary health care to the population in medical organizations: polyclinics, outpatient clinics, inpatient/outpatient facilities of the municipal health care system)
Mode of study	**Full-time**
Period of mastering the BEP	**6 years** (nominal length of study)
Institute	of Fundamentals and Information Technologies in Medicine

Vladivostok, 2025

Subject guide for teachers and students for **Б1.О.05 Medical physics** is based on:

1) Federal State Educational Standard of Higher Education for the specialty approved by the Order No. 988 of Ministry of Science and Higher Education of the Russian Federation
dated August 12, 2020.

2) Curriculum for the specialty 31.05.01 General Medicine for international students (in English), profile 02 "Healthcare" (in the field of providing primary health care to the population in medical organizations: polyclinics, outpatient clinics, inpatient/outpatient facilities of the municipal health care system),
approved by the Academic Council of FSBEI HE PSMU of the Ministry of Health of Russia Report No. 8/24-25 dated March 31, 2025.

Subject guide for teachers and students for the discipline were developed by the writing team of the Institute of Fundamentals and Information Technologies in Medicine of the FSBEI HE PSMU of the Ministry of Health of Russia, under the guidance of the director of the institute Candidate of Biological Sciences Startseva M.S.
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Developed by:

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(position held)	(academic degree, academic title)	(full name)

1. GENERAL PROVISIONS

Subject guide for **Б1.О.05 Medical physics** is a set of recommendations and explanations that facilitate to optimal organization of mastering this discipline.

Regular analysis of lecture materials and work with end-of-the-text questions are necessary for better understanding of the material and systematization of knowledge of **Б1.О.05 Medical physics**. Particular attention should be paid to emerging questions, confusing terms, and conflicts of points of view during the independent review of the lecture material. If necessary, a student should contact the teacher for advice. Lecture material streamlines students' thinking, while practical classes provide deeper insight into the material of the discipline.

Special attention should be paid to the content of the main provisions and conclusions, explanation of phenomena and facts, and clarification of the practical application of theoretic aspects of topic when preparing for a practical class. During this process students should aim to understand and remember the main provisions of the material under consideration, examples provided, as well as understand the illustrative material.

Collections of assessment tools are used to organize independent study of topics (questions) of the discipline.

Independent work of students is facilitated by the following:

1. availability and accessibility of the necessary educational and reference material;
2. a system of regular quality control of completed independent work;
3. availability of teacher's advice.

Subject guides for self-study are presented as literary sources and illustrative materials. Subject guides for independent work of students include a list of library resources of the educational institution and other materials accessible to students.

Independent work is a type of in-person extracurricular work of teachers and students of **Б1.О.05 Medical physics**. Control of independent work is conducted by the leading teacher. Evaluation of independent work results is taken into account when conducting interim examination of students throughout the **Б1.О.05 Medical physics** course.

Continuous assessment during the **Б1.О.05 Medical physics** course is implemented in order to check indicators of achieving competencies, to stimulate students' academic work, and improve methods of mastering new knowledge. Continuous assessment during the **Б1.О.05 Medical physics** course is conducted during the semester to assess all types and sections of the academic discipline that encompass the competencies developed by the discipline: working with tests, solving practice problems, and laboratory classes. Continuous assessment of students' knowledge and results of their preparation for practical classes is conducted during every class session.

Interim assessment aims to determine the level of mastery of competency indicators. It is conducted in the test format after the student has mastered all sections of **Б1.О.05 Medical physics** and takes into account learning outcomes for all types of student work over the entire period of mastering the **Б1.О.05 Medical physics** course.

Time allotted for interim assessment is indicated in the schedule.

Assignments given during practical classes, as well as assignments aimed to prepare students for continuous and interim assessment, are included in the collection of assessment tools for **Б1.О.05 Medical physics**. If necessary, students should contact the teacher for advice. It is necessary to thoroughly think over questions that need clarification before seeking teacher's advice.

2. SUBJECT GUIDES FOR LECTURE CLASSES

Table 1. Subject Guides for **Б1.О.05 Medical physics** Lectures

Topic No.3 Acoustics. Sound, its physical and physiological characteristics. Doppler's effect. Ultrasound imaging	
Duration of the lecture (in academic hours):	2
Purpose of the lecture: 1. tell students about mechanical vibrations of different frequency ranges (infra-, ultra-, hyper-, and audible sound); 2. define main characteristics of mechanical vibrations; 3. examine use of sound and vibrations in therapeutic and diagnostic methods.	
Lecture plan, order of presentation of its sections: 1. Mechanical waves, wavelength, frequency, speed, energy. 2. Sound as a mechanical wave, wave on motion (equation). 3. Physical characteristics of sound and characteristics of auditory sensation. 4. Structure of the human ear as a sound-conducting system. 5. Hearing threshold and pain threshold. 6. Audiometry method and audiogram. 7. The physical foundations of auscultation and percussion methods. 8. Ultrasound and frequency range. 9. Reflection of ultrasound in soft tissues. 10. Elastography. 11. Echolocation, Ultrasound diagnostics. 12. Doppler effect. Doppler imaging.	
Recommended reading: 1. Medical and biological physics: textbook by A.N. Remizov, 4th ed., (M.: ГЭОТАР-Медиа), 2018. 2. Biophysics: Textbook for Universities Edited by V.G. Artyukhov; Moscow: Academical Project, 2020. 3. "Medical and Biological Physics". A course of lectures with tasks by V. N. Fedorov and E. V. Faustov, (M.: ГЭОТАР-Медиа), 2015. 592 p.	
Topic No.2 Thermodynamics and biopotentials, Laws of thermodynamics, statistics and probability, Entropy and potentials, Membranes	
Duration of the lecture (in academic hours):	2
Purpose of the lecture: 1. tell students about the basic mechanic characteristics of the cardio-vascular system; 2. define linear and volumetric blood flow, work and heart power, systolic and diastolic pressure; 3. examine models of the heart, their pros and cons.	
Lecture plan, order of presentation of its sections: 1. Models of blood circulation. Pros and cons. 2. Volume and linear velocity of blood flow. 3. Distribution of blood flow velocity through the vascular bed. 4. Pulse wave. Pulse wave equation. 5. Work and power of the heart. 6. Arterial blood pressure. 7. Distribution of pressure along the vascular bed. 8. Physical method of measuring blood pressure.	

9. Determination of blood flow velocity.
Recommended reading: 1. Medical and biological physics: textbook by A.N. Remizov, 4th ed., (M.: ГЭОТАР-Медиа), 2018. 2. Biophysics: Textbook for Universities Edited by V.G. Artyukhov; Moscow: Academical Project, 2020. 3. "Medical and Biological Physics". A course of lectures with tasks by V. N. Fedorov and E. V. Faustov, (M.: ГЭОТАР-Медиа), 2015. 592 p.

3. SUBJECT GUIDES FOR PRACTICAL CLASSES

Table 2. Subject Guides for Practical **Б1.О.05 Medical physics** Classes

Topic No. 5 Characteristics and types of oscillations. Superposition and decomposition of oscillations. Mechanical waves. Wave energy flux. Sound characteristics and auditory sensations. Practical use of mechanical waves in medicine	
Duration of the practical class (in academic hours):	2
Purpose of the practical class: 1. consolidate acquired knowledge on sound and its characteristics; 2. during the discussion, outline how to compare and calculate physical characteristics auditory sensation; 3. examine the audiometry method.	
Practical classes requirements: classroom equipped with multimedia equipment, a blackboard, and laboratory equipment.	
Independent work of the student: working with study materials, solving practice problems.	
Methods of evaluation of acquired knowledge and skills: classroom questioning, discussions, tests.	
Recommended reading: 1. Medical and biological physics: textbook by A.N. Remizov, 4th ed., (M.: ГЭОТАР-Медиа), 2018. 2. Biophysics: Textbook for Universities Edited by V.G. Artyukhov; Moscow: Academical Project, 2020. 3. "Medical and Biological Physics". A course of lectures with tasks by V. N. Fedorov and E. V. Faustov, (M.: ГЭОТАР-Медиа), 2015. 592 p.	
Topic No. 5 Audiometric method	
Duration of the practical class (in academic hours):	2
Purpose of the practical class: 1. Practice the audiometry method; use collected data to create an audiogram; identify the most sensitive hearing human ranges.	
Practical classes requirements: classroom equipped with multimedia equipment, a blackboard, laboratory equipment, and subject guides for the discipline.	

Independent work of the student: working with study materials, solving practice problems.
Methods of evaluation of acquired knowledge and skills: preparing a laboratory class report, working with control questions.
Recommended reading: 1. Medical and biological physics: textbook by A.N. Remizov, 4th ed., (M.: ГЭОТАР-Медиа), 2018. 2. Biophysics: Textbook for Universities Edited by V.G. Artyukhov; Moscow: Academical Project, 2020. 3. "Medical and Biological Physics". A course of lectures with tasks by V. N. Fedorov and E. V. Faustov, (M.: ГЭОТАР-Медиа), 2015. 592 p.

4. GUIDELINES FOR CONTINOUS AND INTERIM ASSESSMENT

Table 3. Guidelines for Conducting Continuous and Interim Assessment during the **Б1.О.05 Medical physics** Course

Type of assessment	Assessment format
Continuous assessment	- conducting and evaluating oral or written quizzes during lectures and practical classes; - assessment and evaluation of completion and results of assignments given during practical classes; - assess and evaluate completion and results of individual assignments and exam tasks given during practical classes; - assessment and evaluation of lecture notes quality; - assessment and evaluation of completion and results of tests.
Interim certification	is conducted in the test format; it allows to assess the development of students' competencies correlating with types of professional activity.

5 ASPECTS OF THE IMPLEMENTATION OF THE COURSE FOR STUDENTS WITH DISABILITIES AND SPECIAL NEEDS

5.1. Availability of accessible environment

For students with disabilities and special needs, if a written application is submitted, lectures and practical classes are carried out taking into account health limitations, individual capabilities and medical status (hereinafter referred to as individual characteristics) of the student. Compliance with the following general requirements is ensured: teaching aids for collective and individual use are provided, required technical assistance is provided by an assistant, buildings and premises where lectures and practical classes are taking place meet accessibility requirements, other arrangements lack of which makes it impossible or difficult to master the discipline are made.

5.2. Compliance with general requirements

When lectures and practical classes are carried out at the written application of the student, the following general requirements are met: lectures and practical classes for students with disabilities and special needs take place at the same location as for students who do not have disabilities, if this does not cause difficulties for students; an assistant (assistants), who provide(s) students with the necessary technical assistance taking into account individual characteristics of the student, is (are) provided; necessary teaching aids are provided, taking into account individual characteristics of the student.

5.3. Availability of the internal policies and procedures of FSBEI HE PSMU of the Ministry of Health of Russia to students with disabilities in a form accessible to them.

All internal policies and procedures of FSBEI HE PSMU of the Ministry of Health of Russia concerning the discipline are made available to students with disabilities in a form accessible to them.

5.4. Increase in the duration of interim assessment of students with disabilities and special needs in relation to the established duration

Format of the interim assessment of academic performance within the scope of the discipline for students with disabilities and special needs is selected taking into account individual characteristics (orally, by writing on paper, by typing on a computer, as a test, etc.). The duration of the interim assessment in relation to the established duration is increased at the written application of the student with disabilities. Time limit for the student's preparation for the test is increased by at least 0.5 hours

6. STAFFING REQUIREMENTS OF THE DISCIPLINE

Academic teaching personnel that ensure the implementation of the discipline education process meet the requirements of the Federal State Educational Standard of Higher Education for the 31.05.01 General Medicine for international students (in English) specialty; list of the aforementioned personnel is available on the website of the educational organization.