# FACULTY MEDICINE

## STUDY PROGRAM 0912.1 MEDICINE

### DEPARTMENT OF HUMAN PHYSIOLOGY AND BIOPHYSICS

APPROVED
at the meeting of the Commission for Quality Assurance and Evaluation of the Curriculum in Medicine
Minutes No. 5 of 04.04.24
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APPROVED
at the Council meeting of the Faculty Medicine _____
Minutes No. 8 of 23.04.24
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APPROVED
approved at the meeting of the department Human Physiology and Biophysics
Minutes No. 18 of 25.03.2024
Head of department, Ph. D., assoc. professor,
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# SYLLABUS

## DISCIPLINE **BIOPHYSICS OF FUNDAMENTAL INVESTIGATIONS IN MEDICINE**

**Integrated studies**

Tipe of course: **Optional course**


Syllabus developed by the team of authors:
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# I. INTRODUCTION

- **General presentation of the discipline: place and role of the discipline in the formation of the specific competences of the professional / specialty training program**

The biophysics of fundamental investigations in medicine studies the investigative, therapy, monitoring and laboratory equipment used in biology and medicine, as well as the principles, methods and techniques that underlie the exploitation of medical investigations. The intense development of science has stipulated the emergence of new physical methods, X-ray structural analysis, radiospectroscopy, spectrometry, optical measurement methods, methods based on nuclear magnetic resonance (NMR). Studies of MRI phenomena and the propagation of ultrasound waves in tissues have led to the creation of new diagnostic methods - ultrasound, MRI, SPECT, PET, etc. Physiotherapy devices are created based on the influence of ultra-high frequency waves, varied spectrum lasers, UV radiance, etc.

- Mission of the curriculum (aim) in professional training

The study of the principles of the Biophysics of fundamental investigations in medicine involves the following ideas: to understand the mechanisms, physical changes and efficiency of different subsystems of the body; to design and implement a system of instruments used in diagnosis, therapy or to supplement a body function; to gain quantitative and qualitative knowledge of various tools that can help analyze diseases and other elements used in the process of treating diseases.

- Language of the discipline: English.
- Beneficiaries: students of the 1st year, faculty Medicine II.

# II. MANAGEMENT OF THE DISCIPLINE

| | | | |
|---|---|---|---|
| Code of discipline | | **F.02.A.018.1** | |
| Name of the discipline | | **Biophysics of fundamental investigations in medicine** | |
| Persons in charge of the discipline | | **Natalia Gubceac, lecturer** | |
| Year | **I** | Semester | **II** |
| Total number of hours, including: | | | **30** |
| Lectures | **10** | Practical/laboratory hours | **10** |
| Seminars | - | Self-training | **10** |
| Form of assessment | **E***** | Number of credits | **1** |

# II. TRAINING AIMS WITHIN THE DISCIPLINE

***At the end of the discipline study the student will be able to:***

- ***at the level of knowledge and understanding:***

✓ To know the fundamental principles that delimit the biological system from the physical systems;
✓ To understand the physical essence of fundamental investigations;
✓ To know at a quantitative and qualitative level the diagnostic tools and other elements used in the process of treating the diseases;
✓ To understand the physical basis of other disciplines such as Physiology, Radiology, Nuclear Medicine and others, through the use of acquired knowledge;
✓ To distinguish and explain the mechanisms of action of physical factors in fundamental investigations.

- ***at the application level:***

✓ To interpret the methods and laws of physics for the complete understanding of the phenomena that appear in biological systems
✓ To identify criteria for classifying the physical factors that are present in the fundamental investigations;
✓ To distinguish the physical methods of investigation indispensable both in the medical practice directly related to the

patient and in the clinical laboratory

- ✓ To determine the biological relevance of the action of physical factors of different nature on the function of the living system.

- ***at the integration level:***

- To express and argue their own opinion about the importance and place of physics in medicine;
- To estimate the role of physical and physico-chemical processes that ensure the vital activity of the human body;
- To use modern methods of research of physical phenomena and processes in the human body;
- To facilitate permanent contact with everything new in science and new methods of medical investigation.

## IV. PROVISIONAL TERMS AND CONDITIONS

In order to achieve the curriculum, the student of the 1st year must meet the following requirements:

- ✓ knowledge of the language of instruction;
- ✓ proven skills in biology, chemistry, physics at upper secondary level;
- ✓ skills in the field of information technologies (using the Internet, documenting with computer, using graphics software);
- ✓ communication skills and teamwork.

## V. THEMES AND ESTIMATE ALLOCATION OF HOURS

***Lectures, practical hours/ laboratory hours/seminars and self-trening***

| Nr. d/o | THEME | Number of hours | | |
|---|---|---|---|---|
| | | Lectures | Practical works | Self-training |
| 1. | Classification of medical devices. Temperature. | 2 | 2 | 2 |
| 2. | Nuclear imaging techniques: MRI, PET, SPECT scan. | 2 | 2 | 2 |
| 3. | Current assessment | - | 1 | 1 |
| 4. | Medical informatics and telemedicine. | 2 | 1 | 1 |
| 5. | Ultrasound and their applications in medicine. Ultrasonography. | 2 | 1 | 1 |
| 6. | Blood pressure. Apparatus for measuring blood pressure. | 2 | 2 | 2 |
| 7. | Current assessment | - | 1 | 1 |
| **Total** | | **10** | **10** | **10** |

## VI. PRACTICAL TOOLS PURCHASED AT THE END OF THE COURSE

## VII. OBJECTIVES AND CONTENT UNITS

| Objectives | Content units |
|---|---|
| **Theme (chapter) 1. Classification of medical devices. Temperature.** | |
| • To define the notions of thermocouple, biomaterials, biotechnology, | Classification of biomedical |

| Objectives | Content units |
|---|---|
| nanotechnology<br>• To know the working methods and physical principles for several types of fundamental investigations in medicine;<br>• To classify the branches of biomedical technology<br>• To classify medical devices according to the purpose, function and degree of danger of the methods used<br>• To use and help optimize medical technologies; | devices. Diagnostic devices<br>Medical imaging. Therapy equipment<br>Temperature. Electric thermometer (Thermocouple) |
| **Theme (chapter) 2. Nuclear imaging techniques: MRI, PET, SPECT scan.** | |
| • To know and define the notions of radioactivity, half-life, fission, fusion, radioactive decay<br>• To classify the methods of nuclear imaging according to efficiency, necessity, applicability, cost, etc.<br>• To explain the principle of operation of nuclear reactors and nuclear magnetic resonance<br>• To analyze and distinguish between nuclear imaging techniques<br>• To be able to organize and execute research on diagnosis and treatment procedures;<br>• To apply new notions and knowledge gained in medical practice | Radioactivity. Nuclear forces.<br>Radioactive decay. Half time. Radiation detectors<br>Fission and fusion. Nuclear reactors. Thermonuclear fusion<br>The magnetic field. Nuclear magnetic resonance. Nuclear imaging methods: PET, SPECT scan |
| **Theme (chapter) 3. Medical informatics and telemedicine** | |
| • to know the usefulness of information technology for organizing, storing, processing and transmitting information,<br>• to develop the basis of medical information systems for informational support of diagnostic and treatment processes;<br>• to develop a management of medical technologies. | Data acquisition systems. Basic computer components.<br>Computer systems applied in medical structures.<br>Telemedicine. |
| **Theme (chapter) 4. Ultrasound and their applications in medicine. Ultrasonography.** | |
| • To know the notions of ultrasound, transducer, Doppler effect, ultrasound.<br>• Explain the principle of ultrasound propagation and reception<br>• To analyze the differences between ultrasound imaging methods by efficiency, necessity, applicability, cost, etc.<br>• To define the speed of propagation of ultrasonic waves, the specific acoustic impedance and the reflex interface, the attenuation, absorption and diffusion of ultrasonic waves by the tissue, the acoustic power and the intensity<br>• Explain the nonlinear propagation effects of ultrasound<br>• To analyze the mechanisms of ultrasound action on the tissue. | Ultrasound propagation through biological tissues.<br>Ultrasonic transducers. Principle of operation of the ultrasonic transducer<br>Basic principles of medical ultrasonography |
| **Theme (chapter) 5. Blood pressure. Apparatus for measuring blood pressure.** | |
| • To define the notions of hemodynamics, pressure (arterial, venous, intrapulmonary, intraocular), plethysmography, Korotkoff sounds<br>• To know the sizes characteristic of blood pressure<br>• To classify methods for measuring blood pressure<br>• To know and distinguish between devices for direct and indirect measurement of blood pressure, according to their principle of operation<br>• To explain the methods of determining the arterial pulse by plethysmography<br>• To develop a management of medical technologies | Physiological pressures. Methods of measuring blood pressure.<br>Devices for indirect measurement of blood pressure.<br>Sphygmomanometer and stethoscope, stethoscope). Direct blood pressure measurement. |

| Objectives | Content units |
|---|---|
| • To apply new notions and knowledge gained in medical practice | |

# VIII. PROFESSIONAL (SPECIFIC (SC)) AND TRANSVERSAL (TC) COMPETENCES AND STUDY FINALITIES

## ✓ Professional (specific) (SC) competences

**PC1.** Knowledge, understanding and use of language specific to this discipline;
**PC2.** Explanation and interpretation of biophysical processes;
**PC3.** Solving situation problems and formulating conclusions;
**PC5.** Comparison of different biophysical processes;
**PC6.** Analysis of the results, their interpretation and elaboration of the report.

## ✓ Transversal competences (TC)

**TC1.** Improving the capacity for decision-making autonomy;
**TC1.** Formation of personal attitude;

## ✓ Study finalities

**Note. Discipline finatities** (are deduced from the professional competences and the formative valences of the informational content of the discipline).

- ✓ To be able to evaluate the place and role of this discipline in the preclinical training of the student;
- ✓ To be competent to use the knowledge and methodology of biophysics in the ability to explain the nature of physiological processes;
- ✓ To be able to implement the knowledge gained in the research activity;
- ✓ To be competent to use critically and confidently the scientific information obtained using new information and communication technologies.

# IX. STUDENT'S SELF-TRENING

| No. | Expected product | Implementation strategies | Assessment criteria | Implementation terms |
|---|---|---|---|---|
| 1. | Working with information sources | Reading the lecture or the material in the manual carefully; To get acquainted with the list of additional information sources on the topic; Select the source of additional information on the topic; Reading the text entirely, carefully and writing the essential content; Formulate conclusions about the importance of the topic / subject. | • Ability to extract the essentials;<br>• interpretative skills; | During the semester |

# X. METHODOLOGICAL SUGGESTIONS FOR TEACHING-LEARNING-ASSESSMENT

## ✓ *Teaching and learning methods used*

Discipline Biophysics of fundamental investigations in medicine is an optional subject and is taught in the form of lectures. The theoretical course for lectures is given by the course holders.

✓ ***Applied*** *(specific to the discipline)* ***teaching strategies / technologies***
PPT presentations

✓ ***Methods of assessment*** *(including the method of final mark calculation)*

***Current***: frontal and / or individual control through: computer-assisted testing

***Final***: computer-assisted testing.

**Method of mark rounding at different assessment stages**

| Intermediate marks scale (annual average, marks from the examination stages) | National Assessment System | ECTS Equivalent |
|---|---|---|
| **1,00-3,00** | **2** | **F** |
| **3,01-4,99** | **4** | **FX** |
| **5,00** | **5** | **E** |
| **5,01-5,50** | **5,5** | |
| **5,51-6,0** | **6** | |
| **6,01-6,50** | **6,5** | **D** |
| **6,51-7,00** | **7** | |
| **7,01-7,50** | **7,5** | **C** |
| **7,51-8,00** | **8** | |
| **8,01-8,50** | **8,5** | **B** |
| **8,51-9,00** | **9** | |
| **9,01-9,50** | **9,5** | **A** |
| **9,51-10,0** | **10** | |

The average annual mark and the marks of all stages of final examination (computer assisted, test, oral) - are expressed in numbers according to the mark scale (according to the table), and the final mark obtained is expressed in number with two decimals, which is transferred to student's record-book.

*Absence on examination without good reason is recorded as "absent" and is equivalent to 0 (zero). The student has the right to have two re-examinations in the failed exam.*

## XI. RECOMMENDED LITERATURE:

*A. Compulsory:*

1. A.A. Feiler, A-M. Ungureanu, Manual de radiologie şi imagistică medicală, Timişoara 2012.

*B. Additional*

1. D. Croitoru, V. Iaţuhno ş.a. Laboratornîi practicum po Biofiziche, Chişinău,2002.
2. D. Croitoru şi al. Lucrări practice de fizică medicală. Chişinău.,Universitas,2005.
3. D. Croitoru, E. Aramă. Lucrări practice de biofizică. Chişinău, 1996.
4. N. Gubanov. Mediţinscaia biofizica. Moscva, Mediţina, 1978.