**INTERNATIONAL HIGHER SCHOOL OF MEDICINE**

**Department of Natural Sciences Disciplines**

# SYLLABUS

**Medical Physics and Higher Mathematics**

2025-2026 academic year

for students of medical faculty

1st course I semester, groups 1-42

3 credits (90 h, including auditorial 54 h, independent work – 36 h)


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**Venue:** Zoom

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The Syllabus is considered
at the meeting of the department of Natural Sciences Disciplines
Protocol №5 dated 30.01.2026
Head of the department Ch. S. Ismailova

**Course Objective:** The main objective of the course of medical and biological physics is to provide biophysical, physical and technical knowledge to medical students; to install the skills needed for the direct formation of a thinker-doctor, practicing and improving his professionalism; both the development of intellectual and practical skills in the field of physical experiment, to assess the physical characteristics of a human; formation of independent thinking and creative approach to cognitive activity.

After study of the discipline the student must:

**Knowledge:**

- basics of differential and integral calculus theory;
- methods of mathematical statistics and their use in epidemiological studies;
- basics of biomechanics;
- mechanical properties of tissues and liquids;
- biophysical basics of hemodynamics;
- biophysics of membrane;
- biophysics of the nerve impulse;
- laws of physics applicable to the processes in the human body;
- the impact of the factors adversely affecting human health, from the point of view of physics.
- basic physical principles of functioning of definite organs;
- forms and mechanisms of regulation of physiological functions,
- factors providing interaction with the environment
- biophysical methods for the research of physiological functions

**Skill:**

- to use the laws of physics in the analysis of organisms' vital processes, a variety of physiological phenomena.
- to recognize the physical principles lying in the basis of various methods of investigation of patients, to evaluate the significance of these findings for the body.
- to distinguish the nature of the physical factors used for therapeutic purposes, to measure (to dose the intensity of these factors in medical procedures, to understand the primary effect of these factors on the body).

**Attitude:**

- technique for taking the spectral characteristics of the ear at the threshold of hearing (audiograms) using an audiometer;
- method for determining the loudness of sound by its intensity level and frequency (according to curves of equal loudness);
- electrocardiograph adjustment technique;
- the skill of working with a refractometer, saccharimeter, photoelectrocolorimeter
- skills of using the mathematical apparatus in medical practice and in a scientific experiment

**Pre-requisites.** Elementary and higher mathematics (sections: elementary functions, algebra), school physics course, school chemistry course, general biology.

**Post-requisites.** Basic pharmacology, Normal physiology, fundamentals of radiology. internal illnesses, epidemiology.

**THEMATIC PLAN OF LECTURES**

| № | Theme of lecture | Hours | Date |
|---|---|---|---|
| 1. | Fundamentals of the theory of probability and mathematical statistics | 2 | 12.02.26 |
| 2. | The mechanical properties of tissues. Biomechanics. Newton's Laws | 2 | 19.02.26 |
| 3. | Basics of biorheology and hemodynamics | 2 | 26.02.26 |
| 4. | Mechanical oscilations and waves | 2 | 05.03.26 |
| 5. | Biological Membrane. Biological Thermodynamics. | 2 | 12.03.26 |
| 6. | The action of electric currents and electromagnetic fields on biological objects | 2 | 19.03.26 |
| 7. | Medical electronics | 2 | 26.03..26 |
| 8. | Optics | 2 | 02.04.26 |
| 9. | Ionizing radiation. Dosimetry Elements of quantum physics | 2 | 09.04.26 |

**THEMATIC PLAN OF PRACTICAL CLASSES**

| № | Theme of practical class | Hours | Date |
|---|---|---|---|
| 1. | Elementary functions (logarithmic, trigonometric, exponential, etc.) | 2 | 09.02-14.02.26 |
| 2. | Fundamentals of differential calculus (differential, partial derivatives, total differential, the use of differentials in approximate calculations) | 2 | 16.02-21.02.26 |
| 3. | Fundamentals of Integral Calculus (indefinite and definite integrals, integration | 2 | 23.02-28.02.26 |

| | | | |
|---|---|---|---|
| | techniques) | | |
| 4. | Random variables. Basics of mathematical statistics | 2 | 02.03-07.03.26 |
| 5. | Elements of probability theory. | 2 | 09.03-14.03.26 |
| 6. | Module I | 2 | 16.03-21.03.26 |
| 7. | Biomechanics. Fundamentals of Materials. Solving problems | 2 | 23.03-28.03.26 |
| 8. | Laboratory work # 1. Viscosity coefficient of fluid. Stokes' method | 2 | 30.03-04.04.26 |
| 9. | Basics of bioacoustics. Physics of hearing | 2 | 06.04-11.04.26 |
| 10. | Laboratory work # 2. Determination of thermal conductivity of the air. | 2 | 13.04-18.04.26 |
| 11. | Thermoregulation of the human body | 2 | 20.04-25.04.26 |
| 12. | Module II | 2 | 27.04-02.05.26 |
| 13. | Physical fundamentals of electrocardiography. Laboratory work # 3. Bio-potentials. The work of bio-amplifier. | 2 | 04.05-09.05.26 |
| 14. | Laboratory work # 3. Study of the light polarization. Malus Law. | | 11.05-16.05.26 |
| 15. | Action of ionizing radiation on a human body | 2 | 18.05-23.05.26 |
| 16. | Laboratory work # 4. Determination of the wavelength of gel-neon laser radiation using a diffraction grating | 2 | 01.06-06.06.26 |
| 17. | Physical principle of MRI | 2 | 08.06-13.06.26 |
| 18. | Module III | 2 | 15.06-20.06.26 |

**THEMATIC PLAN OF INDEPENDENT WORK OF STUDENTS**

| № | Theme of independent work | Hours | Date |
|---|---|---|---|
| Unit I | Fundamentals of mathematical analysis.<br>Introduction to mathematical statistics | 16 | 09.02-21.03.26 |
| Unit II | Fundamentals of biomechanics, biorheology and hemodynamics. Thermodynamics of biological systems. Biophysics of membrane processes | 10 | 23.03-02.05.26 |
| Unit III | Electrodynamics. Optical methods, their use in biology, medicine. Quantum-mechanical research methods. Radiation physics | 10 | 04.05-20.06.26 |

**Recommended reading for the discipline:**

**1.Basic**

1. Nelkon M. "Advanced Level Physics" 7ed (1995).
2. Nelkon M. "Advanced Level Physics" part 1-2(1995).
3. Nelkon M. "Advanced Level Physics" part 3-4(1995).
4. Amanbaeva G.M. "Higher Mathematics" (2016).
5. Amanbaeva G.M., Ismailova Ch.S. "Medical and Biological Physics", Laboratory Works (I Part) (2023).
6. Amanbaeva G.M., Ismailova Ch.S. "Medical and Biological Physics", Laboratory Works (II Part) (2023).
7. Manzhikova S. Ts. "Bases of Statistical Analysis Medical and Biological Data Using Excel" (2020).

**2.Additional**

1. Albert Rutherford, JatH.Kim PhD "The Art of Statistical Thinking" (2022).
2. Alexander C.Mamourian "Practical MR Physics" (2010).
3. Neil A. Weis "Introductory statistics" (2019).
4. Herman, Irving "Physics of the Human Body" 3rd edition (2014).
5. Paul Davidovits "Physics in Biology and Medicine", 3rd edition (2008).
6. Lawrence Davis "Body Physics: motion to metabolism" (2020).

**Resources of the information and telecommunication network "Internet"**

1. https://www.skillsyouneed.com/num/simple-statistical-analysis.html
2. http://whatis.techtarget.com/definition/statistical-analysis
3. https://www.youtube.com/watch?v=LMSyiAJm99g
4. https://www.youtube.com/watch?v=MXaJ7sa7q-8
5. https://www.youtube.com/watch?v=uHRqkGXX55I

**Grading policy and procedures for all types of work**

For the period of studying the discipline, the student gains points for the relevant parameters (per unit):
current score - 40 points
independent work - 20 points
control score (final assessment of knowledge per unit) - 40 points
Maximum score - 100 (40+20+40)

## Rating

| | | | Final score | Reduction of progress rating |
|---|---|---|---|---|
| **U1** | Current activity Max 40 | Total score for unit 1 **UN1=U1+U2+U3** Max 100 | **FI=$\frac{UN1+UN2+UN3}{3}$** Final Initial Score on the discipline (FI) is a mean of 3 units. In each unit the maximal score is 100 which consists of the following components: current activity – (max 40), individual work – (max 20), test on unit – (max 40). | **A**-deduction on attendance<br>A= (-2) (up to 25% of absences)<br>A= (-5) (25%-50% of absences)<br>A= (-10) (more than 50% of absences)<br><br>**B** - Additional deduction from 1 to 10 can be for violation of ethical behavior such as Being late to class, prompting, re-writing during control works, plagiarism in performing independent work, etc.<br><br>Final score on a discipline(FD) is your Final Initial Score with the consideration of reductions:<br><br>**FD = FI – A - B** |
| **U2** | Independent work Max 20 | | | |
| **U3** | control score (final assessment of knowledge per unit) (Module) Max 40 | | | |
| **U4** | Current activity Max 40 | Total score for unit 2 **UN2=U4+U5+U6** Max 100 | | |
| **U5** | Independent work Max 20 | | | |
| **U6** | control score (final assessment of knowledge per unit) (Module) Max 40 | | | |
| **U7** | Current activity Max 40 | Total score for unit 3 **UN3=U7+U8+U9** Max 100 | | |
| **U8** | Independent work Max 20 | | | |
| **U9** | control score (final assessment of knowledge per unit) (Module) Max 40 | | | |

An example of a student's scoring on a discipline

| | **Unit 1** | | | | **Unit 2** | | | | **Unit 3** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **U1** | **U2** | **U3** | **UN1** | **U4** | **U5** | **U6** | **UN2** | **U7** | **U8** | **U9** | **UN3** | **FI** | **A** | **B** | **FD** | |
| Ravi | 28 | 15 | 24 | 67 | 24 | 12 | 30 | 66 | 26 | 12 | 26 | 64 | 66 | -5 | -3 | 58 | fail |
| Ram | 32 | 15 | 32 | 79 | 24 | 12 | 30 | 66 | 26 | 20 | 23 | 69 | 71 | -5 | -2 | 64 | passed |

**Grading system for student's achievements**

| Grading criteria per discipline | | | | |
|---|---|---|---|---|
| Maximum score | Intervals | | | |
| | «unsatisfactory» | «satisfactory» | «good» | «excellent» |
| Current control- 40 | 0-23 | 24-30 | 31-35 | 36-40 |
| Interval description | Cannot describe phenomena and processes, solve problems, does not know definitions | Has a weak knowledge of definitions, descriptions of processes and phenomena, makes errors in selecting formulas to solve problems. | Knows definitions and describes processes, solves problems with errors while selecting the correct formulas. | Confidently knows definitions and describes processes, solves problems, and is able to draw conclusions and make inferences. |
| Independent work - 20 | 0-11 | 12-15 | 16-17 | 18-20 |
| Interval description | fragmentary presentations on a given topic;<br>for laboratory work: work not completed, no report | knows the basic definitions on the topic, but inaccurately describes processes and phenomena;<br>for laboratory work: inaccurately describes | knows definitions and describes processes, makes mistakes when choosing formulas for solving problems; | knows definitions and describes processes, makes mistakes when choosing formulas for solving problems; |

| | | | | |
|---|---|---|---|---|
| | | the procedure for performing, the work is not completed, there is no report | for laboratory work: describes the procedure for performing, the work is done, there is no report | for laboratory work: correctly describes the procedure for performing, the work is done, the report is submitted |
| Control work (module) – 40 | 0-23 | 24-30 | 31-35 | 36-40 |
| Interval description | Has not solved any problem correctly, or has less than 60% correct answers on tests. | 60% of the total number of problems are solved correctly, or 60%-75% of the answers on tests are correct. | 76% of the problems are solved correctly, or 76%-89% of the answers on tests are correct. | 90% of the problems are solved correctly, or 90%-100% of the answers on tests are correct. |

**In order to be attested in the discipline the student must have the average score on 3 units 60 and higher.**
**To be attested in a unit the student must have:**

A. Lecture notes and individual work abstracts and >80% of attendance on classes
B. Positive marks of class activity (>23)
C. Positive mark of individual work abstract (>12)
D. Successful final test on unit MCQ (>23)

**Requirements for the implementation of the abstract:**

- ✓ Given by electronic and printed form / 2 slide on page and short notes,
- ✓ Typed in Times New Roman 12, 1.5 interval / escape much text in slide in ppt.
- ✓ The first page / slide should contain the full name of the student, group, semester, the title of the abstract, the data of teacher, the filing date of the abstract.
- ✓ The total essay 4-5 pages.

**Conduct Policy: (lateness, absence, behavior in the auditorium, late submission of work).**
- Punctuality and completion of tasks.
- Mandatory attendance of classes.
- Attending class in a clean medical uniform.
- Eliminating conversations on a cell phone in the classroom.
- Active participation in the learning process.
- Doing homework on time.
- Academic detention at the time specified by the teacher.

For violations of the Conduct Policy, the total points for discipline might be reduced to 1-10 points.

**Academic Ethics Policy.**
- Be tolerant, respect the opinions of others.
- Formulate objections in the correct form.
- Constructively support feedback in all classes.
- Plagiarism and other forms of dishonest work are unacceptable. Plagiarism includes the following: the absence of references when using printed and electronic materials, quotes, thoughts and works of other authors or students.
- Prompting and cheating during tests, exams, classes is unacceptable as well as passing an exam for another student, unauthorized copying of materials.

For violations of the Academic Ethics Policy, the total points for the discipline may be reduced to 1-10 points.
*Request to appearance*: clean accurate doctor's smock (apron).

**Guidelines for the lessons of the discipline**
**Unit 1. Mathematical processing of medical and biological data**
**Key questions covered in lesson 1.** Elementary functions (logarithmic, trigonometric, exponential, etc.). Laws pf exponent. Properties of Logarithms.
Recommended reading for the lesson:
[4] Amanbaeva G.M. "Higher Mathematics" (2016).
**Key questions covered in lesson 2.** Fundamentals of differential calculus (differential, partial derivatives, total differential, the use of differentials in approximate calculations).
Differential of functions of one variable. Partial derivatives and differentials of functions of two or more variables. The full differential. Using differential in approximate calculations.
Recommended reading for the lesson:

[4] Amanbaeva G.M. “Higher Mathematics” (2016).
**Key questions covered in lesson 3.** Fundamentals of Integral Calculus (indefinite and definite integrals, integration techniques).
Indefinite and definite integrals.Method substitution.
Recommended reading for the lesson:
[[4] Amanbaeva G.M. “Higher Mathematics” (2016).
**Key questions covered in lesson 4.** Random variables. Elements of mathematical statistics.
Discrete and continuous random variables. Numerical characteristics of random variables. The laws of distribution of random variables. Selective assessment of statistical characteristics of the population.
Recommended reading for the lesson:
[3] Neil A. Weis “Introductory statistics”, Pearsons, 10th ed. 2016.
[4] Amanbaeva G.M. “Higher Mathematics” (2016).
[7] Manzhikova S. Ts “Bases of Statistical Analysis Medical and Biological Data Using Excel.” (2016).
**Key questions covered in lesson 5.** Elements of probability theory. Theorems of addition and multiplication of probabilities. Tree diagram.
Recommended reading for the lesson:
[4] Amanbaeva G.M. “Higher Mathematics” (2016).
**Key questions covered in lesson 6.** Module I.
Laws pf exponent. Properties of Logarithms. Differential of functions of one variable. Partial derivatives and differentials of functions of two or more variables. The full differential. Using differential in approximate calculations. Indefinite and definite integrals. Method substitution. A random event. The probability of a random event. Theorems of addition and multiplication of probabilities. Conditional probability. A discrete random variable. The law of distribution. Discrete and continuous random variables. Numerical characteristics of random variables. The laws of distribution of random variables. Selective assessment of statistical characteristics of the population. Types of measurements. Absolute and relative measurement error. Types of errors (systematic, random). Processing the results of direct measurements. Processing the results of indirect measurements.

**Unit 2. Fundamentals of biophysics**
**Key questions covered in lesson 1.** Biomechanics. Fundamentals of Materials. Solving problems.
Basic concepts and laws of mechanics, translational and rotational motions. Conservation laws. Fundamentals of Materials. Hooke’s Law. Young’s modulus and Poisson's ratio. The fluidity and stress relaxation.
Recommended reading for the lesson:
[4] Herman, Irving “Physics of the Human Body” 3rd edition (2014).
[5] Paul Davidovits “Physics in Biology and Medicine”, 3rd edition (2008).
[6] Lawrence Davis “Body Physics: motion to metabolism” (2020).
**Key questions covered in lesson 2.** Laboratory work # 1. Viscosity coefficient of fluid. Stokes’ method
The ideal and real fluid.Bernoulli’s equation and continuity of the jet. Viscosity. Laminar and turbulent flow. Newton's formula for the viscous friction. Viscometers. The Reynolds number. Formula of Poiseuille. Concepts of bio-rheology. The flow of viscous liquids. The rheological properties of blood. Flow of blood in the circulatory system.
Recommended reading for the lesson:
[4] Herman, Irving “Physics of the Human Body” 3rd edition (2014).
[5] Paul Davidovits “Physics in Biology and Medicine”, 3rd edition (2008).
[6] Lawrence Davis “Body Physics: motion to metabolism” (2020).
**Key questions covered in lesson 3.** Basics of bioacoustics. Physics of hearing.
Persistent, damped and forced oscillations. The differential equation of harmonic, damped, forced oscillations and their solutions. Resonance. Vibrations. Self-oscillations. Relaxation oscillations.
Wave processes and their characteristics. Wave equation. The differential wave equation. Energy flow.
Objective and subjective characteristics of sound. The intensity, the level of intensity, the volume. The threshold of audibility and pain. Biophysical bases of auditory sensations. Physical bases of audiometry. Ultrasound and infrasound. Sources of ultrasound and infrasound. Features of distribution and biophysical basis of the action of ultrasound and infrasound on biological tissue. The use of ultrasound in medicine.
Recommended reading for the lesson:
[4] Herman, Irving “Physics of the Human Body” 3rd edition (2014).
[5] Paul Davidovits “Physics in Biology and Medicine”, 3rd edition (2008).
[6] Lawrence Davis “Body Physics: motion to metabolism” (2020).
**Key questions covered in lesson 4.** Laboratory work # 2. Determination of thermal conductivity of air.
Determine what is the coefficient of thermal conductivity. Draw an electrical diagram of the installation. Estimate the relative and absolute errors of measurement of thermal conductivity of air.
Recommended reading for the lesson:
[4] Herman, Irving “Physics of the Human Body” 3rd edition (2014).
[5] Paul Davidovits “Physics in Biology and Medicine”, 3rd edition (2008).

[6] Lawrence Davis “Body Physics: motion to metabolism” (2020).

**Key questions covered in lesson 5.** Thermoregulation of the human body.

Thermodynamics. The laws of thermodynamics. Thermodynamic potential. Thermoregulation of the human body**.**

Recommended reading for the lesson:

[4] Herman, Irving “Physics of the Human Body” 3rd edition (2014).

[5] Paul Davidovits “Physics in Biology and Medicine”, 3rd edition (2008).

[6] Lawrence Davis “Body Physics: motion to metabolism” (2020).

**Key questions covered in lesson 6.** Module II.

Basic concepts and laws of mechanics, translational and rotational motions. Conservation laws. Fundamentals of Materials. Hooke's Law. Young's modulus and Poisson's ratio. The fluidity and stress relaxation. The ideal and real fluid. Bernoulli’s equation and continuity of the jet. Viscosity. Laminar and turbulent flow. Newton's formula for the viscous friction. Viscometers. The Reynolds number. Formula of Poiseuille. Concepts of bio-rheology. The flow of viscous liquids. The rheological properties of blood flow of blood in the circulatory system. Newtonian and non-Newtonian fluids, flow curves. Wave processes and their characteristics. Wave equation. The differential wave equation. Energy flow. Determine what is the coefficient of thermal conductivity. Draw an electrical diagram of the installation. Estimate the relative and absolute errors of measurement of thermal conductivity of air. Differential equations of harmonic, damped, forced oscillations and their solutions. Resonance. The equation of the wave. The differential wave equation. The sound, nature of the sound. Physical characteristics of the sound. The logarithmic scale for the measurement of sound intensity level.

Objective and subjective characteristics of sound. The intensity, the level of intensity, the volume. The threshold of audibility and pain. Biophysical bases of auditory sensations. Physical bases of audiometry. Ultrasound and infrasound. Sources of ultrasound and infrasound. Features of distribution and biophysical basis of the action of ultrasound and infrasound on biological tissue. The use of ultrasound in medicine. Thermodynamics. The laws of thermodynamics. Thermodynamic potential. Thermoregulation of the human body**.**

**Unit 3. Basics of Medical Physics.**

**Key questions covered in lesson 1.** Physical fundamentals of electrocardiography. Laboratory work #3. Bio-potentials. The work of bio-amplifier.

Physical and biophysical fundamentals of electrocardiography. Einthoven’s Model (biophysical interpretation of the ECG).

Recommended reading for the lesson:

[4] Herman, Irving “Physics of the Human Body” 3rd edition (2014).

[5] Paul Davidovits “Physics in Biology and Medicine”, 3rd edition (2008).

[6] Lawrence Davis “Body Physics: motion to metabolism” (2020).

**Key questions covered in lesson 2.** Laboratory work # 4. Study of the light polarization. Malus Law.

Lens. The optical system of the eye. The laws of reflection and refraction of light. Total reflection of light. Refractometer.

Recommended reading for the lesson:

[4] Herman, Irving “Physics of the Human Body” 3rd edition (2014).

[5] Paul Davidovits “Physics in Biology and Medicine”, 3rd edition (2008).

[6] Lawrence Davis “Body Physics: motion to metabolism” (2020).

**Key questions covered in lesson 3.** Action of ionizing radiation on a human body(seminar).

Thermal radiation body, its characteristics. Ionizing and non-ionizing radiation. Unit of radiation. An absolutely black and gray body. Kirchhoff’s law. The laws of blackbody radiation: Planck's radiation law, Stefan-Boltzmann law, Wien's displacement law. Heat radiation of the human body. The concept of thermography. Luminescence. The main types of photo biological processes. Stage photo biological processes. The concept of an electron microscope.

Recommended reading for the lesson:

[4] Herman, Irving “Physics of the Human Body” 3rd edition (2014).

[5] Paul Davidovits “Physics in Biology and Medicine”, 3rd edition (2008).

[6] Lawrence Davis “Body Physics: motion to metabolism” (2020).

**Key questions covered in lesson 4.** Laboratory work # 5. Determination of the wavelength of gel-neon laser radiation using a diffraction grating.

Geometric optics. The notion of the ideal centered optical system. Disadvantages of optical system of the eye and their compensation. Resolution and useful magnification. The laws of reflection and refraction of light

Recommended reading for the lesson:

[4] Herman, Irving “Physics of the Human Body” 3rd edition (2014).

[5] Paul Davidovits “Physics in Biology and Medicine”, 3rd edition (2008).

[6] Lawrence Davis “Body Physics: motion to metabolism” (2020).

**Key questions covered in lesson 5.** Nuclear Magnetic resonance.

Resonance methods of quantum mechanics. Nuclear magnetic resonance, electron paramagnetic resonance, their use in medicine (MRI, etc.). Lasers.

Recommended reading for the lesson:

[2] Alexander C.Mamourian “Practical MR Physics” (2010).
[4] Herman, Irving “Physics of the Human Body” 3rd edition (2014).
[5] Paul Davidovits “Physics in Biology and Medicine”, 3rd edition (2008).
[6] Lawrence Davis “Body Physics: motion to metabolism” (2020).

**Key questions covered in lesson 7.** Module III.

Electronics and its objectives. Designation and classification of electronic medical equipment. Typical units being parts of the medical electronic devices and equipment. Electrical safety of medical equipment. Basic concepts of electrodynamics. Electric dipole, current dipole. Physical and biophysical fundamentals of electrocardiography. Einthoven’s Model (biophysical interpretation of the ECG). Lens. The optical system of the eye. The laws of reflection and refraction of light. Total reflection of light. Refractometer. Thermal radiation body, its characteristics. Ionizing and non-ionizing radiation. Unit of radiation. An absolutely black and gray body. Kirchhoff's law. The laws of blackbody radiation: Planck's radiation law, Stefan-Boltzmann law, Wien's displacement law. Heat radiation of the human body. The concept of thermography. Luminescence. The main types of photo biological processes. Stage photo biological processes. The concept of an electron microscope. Geometric optics. The notion of the ideal centered optical system. Disadvantages of optical system of the eye and their compensation. Resolution and useful magnification. The laws of reflection and refraction of light. Resonance methods of quantum mechanics. Nuclear magnetic resonance, electron paramagnetic resonance, their use in medicine (MRI, etc.). Lasers.

**Methodological instructions for the implementation of independent work on the discipline.**

**Unit 1. Mathematical processing of medical and biological data**

Students should know the basic formulas of differentiation and integration, study the materials on introductory statistics and solve exercises and problems on the above topics.

**Unit 2. Fundamentals of biophysics**

Every student is given an individual learning project which must be completed. The results should be reported in the form of presentation. Also students have to perform a laboratory work №5 “Determination of the surface tension coefficient by a loop separation”. The description of the Lab provides all detailed process and theoretical material to study. The report on the Lab must be given to the teacher at the end of unit.

**Unit 3. Fundamentals of medical physics.**

Every group is given one common learning project which must be completed. The results should be reported in the form of presentation. Also students have to perform a laboratory work №6 “The study of the electrostatic field”. The description of the Lab provides all detailed process and theoretical material to study. The report on the Lab must be given to the teacher at the end of unit