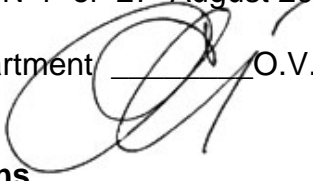


It is approved  
on meeting of department of  
medical informatics, medical and biological physics  
27 August 2020  
Minutes №1 of 27 August 2020

Head of department  O.V. Silkova

### Methodical instructions

for students' self-preparation work at preparation for a practical lesson  
at home and at the classroom

Subject matter           **Medical and biological physics**  
The unit                    2. Bases of medical physics  
Theme of lecture:       **Total module control work #2**  
Year                         1  
Faculty                    Medical  
Speciality                 Medicine

Poltava - 2020

#### The topic significance:

A biophysical processes and phenomena in a human organism have a physical basis. Calculation of various parameters is necessary for comprehension of biological processes, correct diagnostics, forecasting of organism state development and producing of new methods of treatment.

#### Specific targets:

##### To familiarize:

- With basic concepts of topic ;

##### To know:

- Definitions of main terms, laws, concepts, rules ,
- Approaches for medical tasks solution .

##### To skill:

- To use basic laws for analysis of tasks ,
- To explain concept of electrophysics, optics, radiobiology ,
- To solve basic tasks on electrophysics, optics, radiobiology .

#### Basic knowledge, experience, skills necessary for studying the topic in connection with other subjects:

№	Disciplines	To know	To skill
1	The previous (providing) disciplines: informatics, Mathematics, physics, biology	Bases of mathematics, physics, biology	Basic knowledge on mathematics, physics, biology; To know physical properties of biological tissues
2	The following	Basic concepts of the	To define main concepts of the

	disciplines which are provided: Information science, Social hygiene, clinical disciplines	medical physics	biological physics: electric-magnetic properties of tissues, optical properties of tissues, interaction of tissues with electromagnetic radiation and particle flows.
3	Inter-subject integration: Clinical disciplines	Links of knowledge obtained at practice	To use obtained knowledge in practice.

### Theoretical questions to a total modular control №3.

1. Electrical performances of biological tissues. An Ohm's law in the differential shape. Conductance of biological tissues. Capacitive properties. The equivalent circuitry.
2. Biophysical bottoms of electrography. Concept about the equivalent electrical generator. Concept of Einthoven about an electrocardiogram genesis (an integrated electric vector of heart, dipole potential, system of taps).
3. Heart as a current electric dipole (a current dipole and its performances, dipole potential of heart).
4. Impedance of biological tissues. A variance of an impedance. A principal physics of a rheography.
5. Physical processes in bioobjects under activity electrical, magnetic fields and an electromagnetic fields (polarization, conduction currents, the inductive and bias).
6. Principal physics of therapeutic methods (a galvanization, franklinization, a diathermy, inductothermy, d'arsonvalization, UHF- and LHF-therapy, microwave resonant therapy). Thermal and specific activity.
7. Devices of geometrical optics. A centered optical system. An optical microscopy. Performances to the microscope.
8. Polarization light. Expedients of reception of polarized light. Double refraction. The Nicol prism. A Malus law.
9. Optically active materials. An angle of rotation of a polarization plane. The law of the Biot. Concentration polarization.
10. Light absorption. Law of Bougier. A light absorption solutions. Law of Bougier-Lambert-Beer. A concentration colorimetry.
11. Dispersion of light in dispersion mediums. Molecular scattering of light.
12. The basic representations of a quantum mechanics: undular properties of microparticles, the de Broigle formula. Concept about a supermicroscope.
13. Radiation and light absorption atoms and molecules. Spectrums of radiation and absorption. A spectrophotometry.
14. Caloradiance of bodies, its performances. Absolute black and gray bodies. A Kirchhoff's law. A caloradiance of a body of the person. Concept about thermography.
15. Radiation law of an absolute black body: a Planck radiation, a Stefan-Boltzmann law, a Wien displacement law.
16. Photoeffect and its application. Inner and outer photoeffects. Photoelectrical instruments in medicine.
17. Luminescence: types, the basic legitimacies, properties. A Stokes law. Application of a luminescence in medicine.
18. Induced radiation. An equilibrium and inverse population of energy levels. Lasers, a principle of activity and application in medicine.
19. X-rays, spectrum and performances, application in medicine. Interaction of X-rays with material. The law of X-rays attenuation.
20. Radioactivity. Types of radioactivity. Fundamental law of a radioactive decay. A half-life period. Activity, activity units.

21. Ionizing radiation and its types. Interaction of an ionizing radiation with material. Protection against activity of an ionizing radiation. Biophysical basics of interaction of an ionizing radiation with biological tissues.
22. Dose metering of an ionizing radiation. Exposure and absorbed doses. A biological effect of radiation, biological equivalent dose. Power of a dose. Units of doses and powers of doses.

### **Literature recommended**

#### **Main sources.**

- Chaliy A.V. et al., Biological and medical physics. – A.V. Chaliy et al. – Ed. A.V. Chaliy. – Vinnitsia, Nova Knyha, 2013. – 480 pp.
- Korovina L.D. Biophysics with beginnings of mathematical analysis and statistics. Extended course of lectures. Vol.3. Optics. Quantum phenomena. – Poltava, 2018. – 128 p.
- L.D. Korovina. – Biophysics with beginnings of mathematical analysis and statistics. Extended course of lectures. – Vol. 1. Basis of mathematical analysis, probability theory and mathematical statistics. Biomechanics. – Poltava, 2017. – 114 p.

#### **Additional textbook, journals and references:**

- Roland Glaser. Biophysics: An Introduction. – 2010.
- Philip Nelson. Biological Physics (Updated Edition). – 2007.
- Paul Davidovits. Physics in Biology and Medicine, Third Edition (Complementary Science). – 2007.
- Bengt Nölting. Methods in Modern Biophysics. – 2009.

**Methodical elaboration have prepared by senior lecturer, PhD biol.Sc. Korovina L.D.**