



Head of Department.....  
Prof. P. Zagorchev PhD, DBSc

## **Syllabus in Physics** **Pharmacy 1-st year, 1-semester**

(number of classes: 15 weeks, 2 classes each – 30 classes)

**2023/2024**

### **PART I**

1. Physical characteristics of sound: pressure, intensity, frequency, wavelength, transmission speed, impedance, spectrum.
2. Psychophysical characteristics of sound: intensity level, pitch, timber. Auditory area.
3. Sound methods for diagnosis and therapy: audiometry, auscultation, phonocardiography, percussion, blood pressure measuring, ear aids, extracorporeal lithotripsy. Sound protection.
4. Ultrasound (US). Physical properties. Generators and detectors of US. Image diagnosis of US. US therapy.
5. Infrasound (IS). Physical properties. Generators and detectors of IS. Impact of IS on the human body.
6. Transport processes: diffusion, internal friction, heat conductivity. Hemodialysis, heat therapy and cryosurgery.
7. Physics of cardiovascular system. Structure of liquids. Molecule pressure and surface tension. Additional (Laplace) pressure. Embolism.
8. Laminar and turbulent movement of liquids. Blood movement in cardiovascular system. Pulse wave, blood pressure.

## **PART II**

**9.** Electric conductivity of hard conductors. Electric levels and zones in conductors, semi-conductors and non-conductors.

**10.** Direct, pulsing and altering current. Ohm's law. Types of resistance:  $R$ ,  $X_L$ ,  $X_C$ . Impedance. One-way and two-way current rectification.

**11.** Elements of bio-electric devices: transducer, preamplifier, amplifier, record and visualization systems, EMG, EEG, EKG.

**12.** Medical procedures with direct and alternating current. Electric safety.

**13.** Electro conductivity of electrolytes. Faraday laws. Medical electrophoresis.

**14.** Electro conductivity of gases. Types of aeroions. Generators. Biological action of aeroions and their application.

**15.** Magnetic properties of the materials. Origin. Types. Application of image diagnosis MRI. Image forming parameters  $\rho$ ;  $T_1$ ,  $T_2$ .

## **PART III**

**16.** Medical electromagnetic radiation – spectrum, parameters. Reflection, refraction, full inner light reflection. Absorption. Dispersion. Law. Medical application.

**17.** Ultraviolet (UV) and infrared (IR) rays in medicine. Parameters, zones, properties, sources, transformers. Application in image diagnosis (thermovision).

**18.** Luminescence. Characteristics and laws. Application and diagnosis.

**19.** Lasers. Normal and inverse density, spontaneous and artificial radiation. Scheme of a laser operation. Parameters of laser radiation. Types of lasers. Medical application.

**20.** Simple optic lenses – types, parameters, disadvantages. Microscope – optic scheme, resolution and magnification. Techniques for observation with microscope in clinical practice.

**21.** Optic system of the eye: focus elements, optic disadvantages, correction.

Dioptry. Reception system of the eye- spectral sensibility.

- 22.** Ionizing radiation. Interaction between the photon radiation and the matter: coherent dispersion, photoelectric absorption, incoherent dispersion (Compton effect), disintegration of the couple  $e^-e^+$ . Total linear coefficient of weakening.
- 23.** Physical base of the medical diagnostics with X-rays: nature, receiving, linear and uninterrupted spectrum. X-ray apparatus. Factors, determining the X-ray in the clinical practice.
- 24.** Conventional radiography and radioscopy, mammography, angiography. Densitometer (osteometer). Computer tomography (conventional and spiral) and its application in image diagnostics. Parameters forming the image.
- 25.** Basics of the medical image diagnostics and therapy with radio nucleus. Alpha, beta, gamma transformation of the radio nucleus. Activity,  $\lambda$ ,  $T_{1/2}$ . Isomer transition. Radio nucleus generators. SPECT, PET – image diagnosis.
- 26.** Dosimetry of the ionizing radiations. Dosimetric quantities and units. Exposition, absorbed dose, equivalent and effective dose. Tissue weight coefficient.
- 27.** Therapy the X-ray and gamma rays with  $e^-$ ,  $n^-$  and  $p^+$ : deep X-ray therapy, telebrachytherapy with  $^{60}\text{Co}$  and LINAC.
- 28.** Dosimeters and radiometers: ionizing chamber, Geiger-Muller counter and scintillation counter. Films and thermoluminescence sensors.

**Major manuals and textbooks**

**Milieva, E.** *Lecture Guide on Physics for students of medicine.* Medical University – Plovdiv 2009

- Todorov, V. *Medical Physics*, Sofia 2002 [in Bulgarian]

12.09.2023

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