



**SYLABUS OF LECTURES AND PRACTICALS
IN MEDICAL BIOPHYSICS
STUDY PROGRAMME GENERAL MEDICINE
WINTER SEMESTER
ACADEMIC YEAR 2022/2023**



Lectures

1. **20.09. Biophysics of the cell. Membrane transport mechanisms. The resting membrane potential.**
(lector: prof. MUDr. Ján Jakuš, DrSc.)
2. **27.09. The action potential, its origin and propagation. Synaptic transmission.**
(lector: prof. RNDr. Ivan Poliaček, PhD.)
3. **04.10. Muscles – division, summation, superposition, tetanus, biophysics of muscle contraction.**
(lector: prof. RNDr. Ivan Poliaček, PhD.)
4. **11.10. Biophysics of the heart and blood vessels.**
(lector: prof. MUDr. Ján Jakuš, DrSc.)
5. **18.10. Biophysics of the respiration.**
(lector: prof. MUDr. Ján Jakuš, DrSc.)
6. **25.10. Biophysics of sensory perception, receptors – division, laws of perception. Biophysical mechanism.** *(lector: prof. MUDr. Ján Jakuš, DrSc.)*
7. **01.11. Biophysics of light (an eye) and sound perception (an ear).**
(lector: prof. MUDr. Ján Jakuš, DrSc.)
8. **08.11. Environmental biophysics. Effect of gravity, overloading, state of weightlessness. Effect of hypobaria, hyperbaria. Keson`s disease.** *(lector: prof. MUDr. Ján Jakuš, DrSc.)*
9. **15.11. Biocybernetics. Simulation of biological processes. Theory of information. Controlled and regulated biological systems.** *(lector: doc. RNDr. Michal Šimera, PhD.)*
10. **22.11. Radioactivity and ionising radiation. Dosimetry.**
(lector: prof. RNDr. Ivan Poliaček, PhD.)
11. **29.11. Biophysical principles of measurement systems used in biomedical research.**
(lector: Ing. Marcel Veterník, PhD.)
12. **06.12. Biophysical principles of some diagnostic methods in medicine.**
(lector: prof. MUDr. Ján Jakuš, DrSc.)
13. **13.12. Biophysical principles of some therapeutic methods in medicine.**
(lector: prof. MUDr. Ján Jakuš, DrSc.)

Practical sessions

19th September - 30th September 2022

- A 1.** Membrane transport mechanisms, diffusion, osmosis. Osmotic fragility of RBC. Basic properties of liquids, measurement of viscosity of liquids, measurement of the surface tension of liquids (**related chapters: 3, 4, 5**). **Teachers: Šimera, Poliaček, Míšek, Parížek. Assistant: Králiková**
- B 1.** Basics of measurement. Linear function and dependence. Data processing, basic statistics. Determination of mass by means of electric balances. Measurement of the density of liquids by pycnometer. Measurement of the density of blood by means of coppersulphate method (**pages 10 to 12 + chapters 1, 2**). **Teachers: Poliaček, Višnovcová, Veterník, Hamza Sládičeková. Assistant: Cibulková**

3rd October - 14th October 2022

- A 2.** Electric properties of cellular membrane. Electroneurography and electromyography. An evaluation of the time and frequency characteristics. Determination of Chronaxy and Rheobase. Determination of frequency of action potentials. (**chapters: 31, 32**) **Teachers: Šimera, Poliaček, Míšek, Hamza Sládičeková. Assistant: Králiková**

- B 2.** Heat and temperature. Measurement of the body temperature. Measurement of the skin temperature by thermocamera. The thermal capacity of calorimeter. Measurement of cooling power. Air humidity - measurement of characteristics. **(chapters: 12, 13, 14, 15)**

Teachers: Poliaček, Višňovcová, Veterník, Parížek. **Assistant:** Cibulková

17th October - 28th October 2022

- A 3.** Paralelogram and Hering's model of breathing. Measurement of vital capacity. Demonstration of lung function measurement. Model of blood vessel elasticity. Measurement of arterial blood pressure - physical principles. **(chapters: 7, 8, 9, 10, 11)**

Teachers: Jakuš, Višňovcová, Míšek, Parížek. **Assistant:** Králíková

- B 3.** Practical use of spectrophotometry in medicine. Determination of concentration of sucrose by use of refractometer. Measurement of the absorption spectra of haemoglobin and its concentration in venous blood. **(chapters: 16, 17, 25)**

Teachers: Poliaček, Veterník, Višňovcová, Hamza Sládičeková. **Assistant:** Cibulková

31st October - 11th November 2022

- A 4.** Physical properties of sound. Doppler effect. Blood flow velocity measurement with Doppler method. Examination of tissue perfusion by plethysmography probe. Doppler ultrasound: principles and practice. **Teachers:** Šimera, Veterník, Míšek, Hamza Sládičeková. **Assistant:** Králíková

- B 4.** Practical use of a microscope in medicine. Determination of size of biological tissues. Determination of optical power of converging lens. Magnifying glass - measurement of magnification **(chapters: 18, 19, 20)**. **Teachers:** Poliaček, Šimera, Veterník, Parížek. **Assistant:** Cibulková

14th November - 25th November 2022

- A 5.** Electric properties of the tissues. The significance of skin resistance and tissue impedance for human medicine. **(chapters: 28, 29)**

Teachers: Šimera, Veterník, Míšek, Parížek. **Assistant:** Králíková

- B 5.** The eye as an optical system. Principle of image formation on retina. Determination of accommodation width. Snellen charts and determination of visual acuity. Detection of colour blindness. Functional ear model, audiometry, air and bone conduction of sound. **(chapters: 21, 22, 27)**

Teachers: Jakuš, Višňovcová, Míšek, Hamza Sládičeková. **Assistant:** Cibulková

28th November - 9th December 2022

- A 6.** Technique of ECG recording, standard limb leads, description of normal ECG trace. Construction of electrical axis of the human heart. **(chapters: 33, 34)**

Teachers: Šimera, Višňovcová, Míšek, Hamza Sládičeková. **Assistant:** Králíková

- B 6.** Biological significance of ionizing radiation. Dosimetry – dosimeters and principles of measurement. Scintillation methods for measurement of ionising radiation. Gamma rays - determination of absorption. **(chapter: 35)**

Teachers: Višňovcová, Poliaček, Veterník, Parížek. **Assistant:** Cibulková

12th December - 16th December 2022

Compensatory sessions.

19th December - 23rd December 2022

Seminar with a credit test. - Computer room in Educational centre

Teachers: Poliaček, Višňovcová, Šimera, Veterník, Míšek. **Assistant:** Králíková, Cibulková

A - Laboratory A

B - Laboratory B

Approved:

Prof. Ján Jakuš, M.D., PhD., DSc.
Head of the Institute of Medical Biophysics