SYLABUS OF LECTURES AND PRACTICALS IN MEDICAL BIOPHYSICS STUDY PROGRAMME GENERAL MEDICINE WINTER SEMESTER ACADEMIC YEAR 2021/2022

L e c t u r e s

1. **14.09. Biophysics of the cell. Membrane transport mechanisms. The resting membrane potential.** *(lector: prof. MUDr. Ján Jakuš, DrSc.)*
2. **21.09. The action potential, its origin and propagation. Synaptic transmission.** *(lector: prof. RNDr. Ivan Poliaček, PhD.)*
3. **28.09. Muscles – division, summation, superposition, tetanus, biophysics of muscle contraction.** *(lector: prof. RNDr. Ivan Poliaček, PhD.)*
4. **05.10. Biophysics of the heart and blood vessels.** *(lector: prof. MUDr. Ján Jakuš, DrSc.)*
5. **12.10.Biophysics of the respiration.** *(lector: prof. MUDr. Ján Jakuš, DrSc.)*
6. **19.10. Biophysics of sensory perception, receptors – division, laws of perception. Biophysical mechanism.** *(lector: prof. MUDr. Ján Jakuš, DrSc.)*
7. **26.10. Biophysics of light (an eye) and sound perception (an ear).** *(lector: prof. MUDr. Ján Jakuš, DrSc.)*
8. **02.11. Environmental biophysics. Effect of gravity, overloading, state of weightlessness. Effect of hypobaria, hyperbaria. Keson`s disease.** *(lector: prof. MUDr. Ján Jakuš, DrSc.)*
9. **09.11. Biocybernetics. Simulation of biological processes. Theory of information. Controlled and regulated biological systems.** *(lector: doc.RNDr. Michal Šimera, PhD.)*
10. **16.11. Radioactivity and ionising radiation. Dosimetry.** *(lector: prof. RNDr. Ivan Poliaček, PhD.)*
11. **23.11. Biophysical principles of some diagnostic methods in medicine.** *(lector: prof. MUDr. Ján Jakuš, DrSc.)*
12. **30.11. Biophysical principles of some therapeutic methods in medicine.** *(lector: prof. MUDr. Ján Jakuš, DrSc.)*
13. **07.12. Biophysical principles of measurement systems used in biomedical research.** *(lector: Ing. Marcel Veterník, PhD.)*

P r a c t i c a l s e s s i o n s

13th September – 24th September 2021

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, Parízek.* ***Assistant****: Králiková*

B 1. Basics of measurement. Linear function and dependence. Data processing, basic statistics. Determination of volume and mass (electrical balance). Measurement of the bone density by direct method. Measurement of liquid density using indirect method (pycnometer). Measurement of the density of blood by means of coppersulphate method.
(pages 10 to 12 + chapters 1, 2) ***Teachers: Poliaček****, Višnovcová, Veterník, Hamzová.* ***Assistant****: Cibulková*

27th September – 8th October 2021

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

B 2. Heat and temperature. Measurement of the temperature. Calibration of the electric thermometer. Measurement of the skin temperature. Measurement of axillary and sublingual temperatures by medical thermometers. The thermal capacity of calorimeter. Measurement of cooling power. Air humidity -

measurement of characteristics. **(chapters: 12, 13, 14, 15)** ***Teachers: Višňovcová,*** *Poliaček, Veterník, Parízek.* ***Assistant****: Cibulková*

11th October – 22nd October 2021

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 ABP - physical principles. **(chapters: 7, 8, 9, 10, 11)** ***Teachers: Jakuš****, Višňovcová, Míšek, Parízek.* ***Assistant****: Králiková*

B 3. Practical use of spectrophotometry in medicine. Determination of concentration of solutions by use of refractometer. Measurement of the absorption spectra of haemoglobin and its concentration. **(chapters: 16, 17, 25)**
Teachers: Poliaček*, Veterník, Višňovcová, Hamzová.* ***Assistant****: Cibulková*

25th October – 5th November 2021

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, Parízek.* ***Assistant****: Králiková*

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, Hamzová.* ***Assistant****: Cibulková*

8th November – 19th November 2021

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, Hamzová.* ***Assistant****: Králiková*

B 5. The eye as an optical system. Principle of image formation of 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, Parízek.* ***Assistant****: Cibulková*

22nd November – 3rd December 2021

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, Hamzová.* ***Assistant****: Králiková*

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, Parízek.* ***Assistant****: Cibulková*

6th December – 10th December 2021

Seminar with a credit test. – Computer room in Educational centre
Teachers: Poliaček*, Višňovcová, Šimera, Veterník, Míšek, Hamzová, Parízek.* **Assistants**: *Králiková, Cibulková*

13th December – 17th December 2021

Compensatory sessions.

A - Laboratory A **B - Laboratory B**

Approved:

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