SYLLABUS OF LECTURES AND PRACTICALS IN MEDICAL BIOPHYSICS STUDY PROGRAMME GENERAL MEDICINE WINTER SEMESTER ACADEMIC YEAR 2026/2027

L e c t u r e s

1. **17.09. Introduction to the study of medical biophysics. Biophysics of the cell.**
   (lecturer: doc. RNDr. Michal Šimera, PhD.)
2. **24.09. The action potential, its origin and propagation. Synaptic transmission.**
   (lecturer: prof. RNDr. Ivan Poliaček, PhD.)
3. **01.10. Muscles – division, summation, superposition, tetanus, biophysics of muscle contraction.**
   (lecturer: prof. RNDr. Ivan Poliaček, PhD.)
4. **08.10. Biophysics of the heart and blood vessels.**
   (lecturer: doc. Ing. Jakub Míšek, PhD.)
5. **15.10. Biophysics of the respiration.**
   (lecturer: prof. RNDr. Ivan Poliaček, PhD.)
6. **22.10. The biophysical basis of sensory perception. Receptors.**
   (lecturer: doc. RNDr. Michal Šimera, PhD.)
7. **29.10. Biophysics of light (an eye) and sound perception (an ear).**
   (lecturer: doc. Ing. Jakub Míšek, PhD.)
8. **05.11. Biocybernetics. Simulation of biological processes. Theory of information. Controlled and regulated biological systems.**
   (lecturer: doc. RNDr. Michal Šimera, PhD.)
9. **12.11. Effects of physical factors on humans.**
   (lecturer: doc. RNDr. Michal Šimera, PhD.)
10. **19.11. Radioactivity and ionizing radiation. Dosimetry.**
    (lecturer: Mgr. Nadežda Višňovcová, PhD.)
11. **26.11. Biophysical principles of measurement systems used in biomedical research.**
    (lecturer: Ing. Marcel Veterník, PhD.)
12. **03.12. Biophysical principles of some diagnostic methods in medicine.**
    (lecturer: Mgr. Nadežda Višňovcová, PhD.)
13. **10.12. Biophysical principles of some therapeutic methods in medicine.**
    (lecturer: Ing. Marcel Veterník, PhD.)

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

<u>14th September – 25th September 2026</u>

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. **(chapters: 2,3)** ***Teachers: Šimera,*** *Míšek, Beriková, Kuchta, Lukáčová.* ***Assistant****: Králiková*

B 1. Basics of measurement. Linear function and dependence. Data processing, basic statistics. Determination of mass and volume. Measurement of the bone density by direct method, measurement of liquid density by pycnometer. Measurement of the density of blood by means of coppersulphate method. **(chapter: 1)** ***Teachers: Poliaček****, Veterník, Višňovcová, Lukáčová.* ***Assistant****: Kurhajcová*

<u>28th September – 9th October 2026</u>

A 2. Electric properties of cellular membrane. Electroneurography and electromyography. An evaluation of the time and frequency characteristics. Determination of Chronaxy and Rheobase. **(chapters: 3,4)** ***Teachers: Šimera****, Míšek, Kuchta, Lukáčová.* ***Assistant****: Králiková*

B 2. Heat and temperature. Measurement of the temperature. Measurement of the skin temperature - thermocamera. Measurement of body temperature by medical thermometers. The thermal capacity. Measurement of cooling power. Air humidity - measurement of characteristics. **(chapter: 5)**
***Teachers: Poliaček**, Veterník, Višňovcová, Lukáčová.* ***Assistant**: Kurhajcová*

12th October – 23rd October 2026

A 3. Parallelogram 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: 6,7)** ***Teachers: Míšek**, Višňovcová, Šimera, Kuchta, Lukáčová.* ***Assistant**: Králiková*

B 3. Practical use of spectrophotometry in medicine. Measurement of the absorption spectra of haemoglobin. Determination of concentration of solutions by use of refractometer and spectrophotometer. **(chapter: 8)**
***Teachers: Poliaček**, Veterník, Višňovcová, Kuchta, Lukáčová.* ***Assistant**: Kurhajcová*

26th October – 6th November 2026 (from November 2nd to November 6th, groups 7 - 12)

A 4. Physical Properties of Sound. Doppler effect. Blood flow velocity measurement with Doppler method. Doppler effect and ultrasound imaging: principles and practice. **(chapter: 9)**
***Teachers: Šimera**, Míšek, Beriková, Kuchta, Lukáčová.* ***Assistant**: Králiková*

B 4. Practical use of a microscope in medicine. Determination of the size of biological tissues. Determination of optical power of converging lens. Magnifying glass - measurement of magnification. **(chapter: 10)**
***Teachers: Poliaček**, Šimera, Veterník, Beriková, Lukáčová.* ***Assistant**: Kurhajcová*

9th November – 20th November 2026 (from November 9th to November 13th, groups 1 - 6)

A 5. Electric properties of the tissues. The significance of skin resistance and tissue impedance for human medicine. **(chapter: 11)**
***Teachers: Šimera**, Míšek, Veterník, Kuchta, Beriková, Lukáčová.* ***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 color blindness. Functional ear model, audiometry, air and bone conduction of sound. **(chapter: 12)**
***Teachers: Míšek**, Višňovcová, Kuchta, Lukáčová.* ***Assistant**: Kurhajcová*

23rd November – 27th November

Compensatory sessions for anatomy dissection week

30th November – 11th December 2026

A 6. Technique of ECG recording, standard limb leads, description of normal ECG trace. Construction of the electrical axis of the human heart. **(chapter: 13)**
***Teachers: Šimera**, Míšek, Beriková, Kuchta, Lukáčová.* ***Assistant**: Králiková*

B 6. Biological significance of ionizing radiation. Dosimetry – dosimeters and principles of measurement. Scintillation methods for measurement of ionizing radiation. Gamma rays - determination of absorption. **(chapter: 14)**
***Teachers: Višňovcová,** Poliaček, Veterník, Kuchta, Lukáčová.* ***Assistant**: Kurhajcová*

14th December – 18th December 2026

Compensatory sessions.
Special practical course in magnetic resonance. ***Teacher: Štrbák, Jurčová***

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

Approved: doc. RNDr. Michal Šimera, PhD., Head of the Department of Medical Biophysics
prof. RNDr. Ivan Poliaček, PhD., Study Programme Guarantor