COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Jessenius Faculty of Medicine in Martin

Course ID:	**Course title:**
JLF.ÚLBf/J-S-VL-504/15	Medical Biophysics

Educational activities:
Type of activities: practicals / lecture
Number of hours:
per week: 4 / 2 **per level/semester:** 56 / 28
Form of the course: on-site learning

Number of credits: 8

Recommended semester: 1.

Educational level: I.II.

Prerequisites:

Recommended prerequisites:
Basic characteristics of the principles of biophysical process in the organism. Biophysical principles of diagnostics methods and terapeutics methods by ionizing and nonionizing radiation in medicine and basic principles of protection counter ionizing radiation (limits, efective dose and personal dosimetry).

Course requirements:
Students are assessed by means of an oral exam, a credit test, and continuous assessment during exercises and seminars. The assessment of the student's continuous work prior to the oral exam is carried out by adding up the points obtained and classifying them into the following categories:
A maximum of 130 points can be obtained for practical session, i.e. 10 points for each session.
Assessment scale for semester: A ≥ 101, B ≥ 86, C ≥ 71, D ≥ 56, E ≥ 41, Fx < 40.
A maximum of 20 points can be obtained for the credit test, with the following grading scale for the test: A ≥ 18, B ≥ 15, C ≥ 12, D ≥ 9, E ≥ 6, Fx < 6.
The overall assessment of the Medical Biophysics course consists of the semester assessment, the test, and 3 exam questions.
Scale of assessment (preliminary/final): 20/80

Learning outcomes:
After completion of the subject Medical Biophysics, students are able to master the basic physical and physical-chemical processes in biological systems and human body. Students understand biophysical principles of physiological and pathological processes in humans at a level of a cell, tissues and the organ systems. They know and apply to practice the basic biological effects of physical factors affecting the human body and a protection against their harmful influences. They master the biophysical principles of medical instrumentation used in diagnostic and some therapeutical methods.

Class syllabus:
-Structure and function of cell membrane. Transport mechanisms. The resting membrane potential.
-The action potential, its origin and propagation. Synapse and synaptic transmission.
-Biophysical principles of muscle contraction. Skeletal, cardiac and smooth muscle. Biophysical

basics of respiration. External and internal breathing, ventilation, distribution, diffusion and perfusion.
-Biophysics of the circulatory system. Heart as a force pump, structure, function, power output.
-Laminar and turbulent blood flow - basic laws. Blood pressure. Capillary blood flow, filtration in capillary loop, oedema.
-Biophysical mechanism of sensory perception. Biophysics of vision. Biophysics of hearing.
-Recording of electrical and nonelectrical biosignals.
-Interaction of mechanical and meteorological factors with living systems.
-Interaction of electrical and magnetic fields and nonionising radiation with living systems.
-Radioactivity and ionising radiation.
-Origin of ionizing radiation and the interaction of ionizing radiation with living systems, radiological quantities and units. Detection of ionising radiation.
-X-ray imaging techniques. Imaging techniques using radionuclides.
-Biophysical principles of some diagnostical and therapeutical methods in medicine.
-Biocybernetics. Simulation and modelling of biological processes. Theory of information. Controlled and regulated biological systems.

Recommended literature:

Set books:

Misek J., Veternik, M, Jakus J. et al.: Medical Biophysics with Practical Course. University textbook. Jessenius Fac . of Med. Com. Univ. Martin , 2022, 253p. ISBN 978-80-8187-129-0
Ronto, G., Tarjan, I. et al. An Introduction to Biophysics with Medical Orientation. Budapest: Akademiai Kiado, 1999. 448 s. ISBN 96 305 7607 4

Recommended books:

Nave, C. R., Nave, B. C. Physics for the Health Sciences. Philadelphia: W. B. Saunders Comp., 1985. 42l s. ISBN 0-7216-1309-8.
Kukurová, E. Biophysical elixir for students and absolvents of medicine. Bratislava: Comenius University, l99l. 302 s.
Davidovits, P. Physics in Biology and Medicine. Amsterdam: Elsevier, 2013. 331 s. ISBN 978-0-12-386513-7.

Languages necessary to complete the course:

English language

Notes:

Past grade distribution

Total number of evaluated students: 1418

A	ABS0	B	C	D	E	FX
13,89	0,0	20,94	28,49	17,84	16,5	2,33

Lecturers: doc. RNDr. Michal Šimera, PhD., doc. Ing. Jakub Míšek, PhD., prof. RNDr. Ivan Poliaček, PhD., Ing. Marcel Veterník, PhD., Mgr. Nadežda Višňovcová, PhD.

Last change: 10.08.2026

Approved by: prof. MUDr. Anton Dzian, PhD., prof. MUDr. Marián Mokáň, DrSc.,FRCP Edin, prof. MUDr. Andrea Čalkovská, DrSc.