

## COURSE INFORMATION SHEET

<b>University:</b> Catholic University in Ružomberok	
<b>Faculty:</b> Faculty of Health	
<b>Course code:</b> KRAT/54T1003W/15	<b>Course title:</b> Radiological Physics 1
<b>Type and range of planned learning activities and teaching methods:</b> <b>Form of instruction:</b> Lecture / Seminar <b>Recommended study range:</b> <b>hours weekly:</b> 3 / 3 <b>hours per semester:</b> 36 / 36 <b>Teaching method:</b> undefined, course is not included in any study programme	
<b>Credits:</b> 5	
<b>Recommended semester/trimester:</b>	
<b>Level of study:</b>	
<b>Prerequisites:</b>	
<b>Requirements for passing the course:</b> During semester: Written test, maximum 30 pts. Exercises - maximum 30 pts. Final evaluation: Written examination, maximum 40 pts. The student has to obtain 10 pts as minimum from each part of evaluation. The subject evaluation: A – 100%-93% B – 92%-85% C – 84%-77% D – 76%-69% E – 68%-60% FX – 59%- 0%	
<b>Learning outcomes of the course:</b> The objective of the course: To know basic physical processes in organism. To understand physical principles of transformation and transport of energy in organism, cell processes, sight, hearing and other senses, respiratory and blood circulation, locomotor apparatus, signal transport using electric fields. The student has to know the principles of processing control in organism and biological feedback. The student has to know the importance of enviromental biophysics, interaction of enviroment with organism. The student has to know the physical principles of diagnostic and therapeutic machines using ultrasound and non-ionising radiation. Theoretical knowledge: The student gains knowledge from corresponding chapters of physics, which are necessary to understand physiological processes in organism and specific parts of organism: The locomotor apparatus: force, force momentum, energy, power, elastic deformation, ultimate strength. Energy transport and transformation: Energy, heat, work, thermodynamic laws, thermodynamic potentials. Respiration: ideal gas laws, Dalton's law, gas solubility. Blood circulation: pressure, Pascal's law, hydrodynamic laes, viscosity, viscous liquid flow, laminar and turbulent flow. Cell processes: diffusion, Fick's laws, osmotic pressure, dissociation, cations and anions, electrostatic forces, polar properties of water.	

Sight: light reflection and refraction, diverging and converging lens, the lens equation, aperture, transversal and angle magnification, apraxia of lid opening disease, daltonism, astigmatism, light diffraction, resolution, color interference, accommodation, light intensity.

Hearing: sound, wavelength, wave frequency and amplitude, sound velocity in various media, acoustic pressure, impedance, reflection and transmission of the sound wave through the interface of medium, intensity, intensity level, Weber-Fechner law. Wave interference, Doppler effect, shockwave, oscillations, resonance.

Electrical processes in organism: potential, voltage, current, Ohm's law, current and voltage measurement.

Ultrasonography: ultrasound sources, magnetostriction, piezoelectric effect, impedance matching, diverging and converging wave, Doppler shift.

Electromagnetic radiation: microwave, infrared, visible and ultraviolet radiation, black body radiation laws, thermovision, diathermy, light intensity, corpuscular properties of EM radiation, photon energy and momentum.

Practical skills:

The student applies theoretical knowledge in practice. He understands physical principle of processes within organs, which is helpful for understanding the nature of basic examinations. He defines membrane potential and its detection. He is able to describe the effects of visible light, infrared radiation, ultraviolet radiation, microwave radiation. He distinguishes biological rhythms and their clinical relevance. The student is able to operate with ultrasound machine, distinguish various type of detectors and their application in clinics, he gain knowledge about the assistance by USG biopsy and sampling.

#### **Course contents:**

1. The characteristics of the subject. The basic physical processes in organism.
2. Cell biophysics.
3. Locomotor apparatus of human, smooth and skeletal (striated) muscles.
4. Respiration.
5. Blood circulation.
6. Electric processes in organism.
7. Human senses.
8. Sight.
9. Hearing.
10. Environmental biophysics. Biophysics of mechanical stimuli, heat, gravitation and magnetic field.
11. Biophysics of sound, ultrasound, infrasound, ultrasonography.
12. The effects of AC and DC current on organism, diathermy, thermovision.

Laboratory exercises:

1. Introduction. (Lab rules, lab safety, groups creation, statistical evaluation of results, requirements for protocols, evaluation criteria)
2. Blood pressure measurement. Ruffier's test.
3. Anthropometric measurements.
4. Optics (Basic principles of imaging using lenses. Measurement of focus distances of converging lenses and optical density calculation. Measurement of magnifying glass magnification).
5. Skin resistance measurement.
6. Illuminance measurement
7. Investigation of diffusion.
8. Investigation of osmosis.
9. Measurement of skin surface temperature. Thermovision.
10. Ultrasonography.

<p>11. ECG measurement principle, heart electric axis.  12. Vital capacity of the lungs measurement.</p>
<p><b>Recommended or required literature:</b>  1. ŠAJTER, V. et al.: Biofyzika, biochémia a rádiológia. Martin, Osveta, 2006, 226 p.  2. ROSINA, J. - VRÁNOVÁ, J. et al.: Biofyzika pre zdravotnícké a biomedicínske odbory. Praha, Grada 2013. 224 p.  3. NAVRÁTIL, L. - ROSINA, J. et al.: Medicínska biofyzika. Praha, GRADA, 2005, 524 p.</p>
<p><b>Language of instruction:</b>  Slovak language</p>
<p><b>Notes:</b></p>
<p><b>Course evaluation:</b>  Assessed students in total: 145</p>
<p>Course evaluation will be displayed only if the course is included in a study plan.</p>
<p><b>Name of lecturer(s):</b> Ing. Martin Bereta, PhD.</p>
<p><b>Last modification:</b> 27.11.2020</p>
<p><b>Supervisor(s):</b> doc. MUDr. Pavol Dubinský, PhD., prof. MUDr. Anton Lacko, CSc.</p>