**Biophysics examination topics**

1. **Biological thermodynamics. Biogeochemical Cycles.** **First law of thermodynamics.** **Application of Hess law in determination of the energy balance in living systems.** **Isocaloric coefficients. Energetic balance of living organism ( energy income – energy expenditure).** **Second law of thermodynamics.**
2. **Biomembranes. Structure, properties. Fluid mosaic model. Transport through the cell membrane. Simple diffusion. Fick’s Laws of diffusion. Facilitated Diffusion. Endocytosis and pinocytosis.**
3. **Mechanisms of pasive and active transport through the membranes. Osmosis. Osmotic pressure of blood plasma. Active transport- antiport, symport. Na+ K+ pump.**
4. **Electrical properties of biomembranes. Biopotentials.** **NERNST’ Equation. The Resting Potential, Goldmann-Hodgkin-Katz formula. Action potential. Propagation of the active potential in nerve cells. Electrical and chemical synapses.Measuring biopotentials: EEG, EMG, ECG.**
5. **The eye and vision- medical optics. Structure of the eye.** **Photochemical reaction. Spectral sensitivity. Accommodation.** **Optical defects and their correction.**
6. **The ear and hearing- Biophysical mechanisms.** **Structure and function of the ear.** **Transmision and measurement of sound. Sound intensity, pressure and loudness. Relation between sound intensity and ear‘s response.** **Defects of hearing. Audiograms. Hearing aids.**
7. **Ultrasounds. Doppler Effect and applications.**
8. **Optic fibers and lasers. Total internal reflection in optic fiber. Applications-the endoscope. Laser- stimulated emission. Lasers in medicine.**
9. **Ionizing radiation. Radioactivity. Dosimetry. X-rays production. Basics of classical radiography.**

**Radiotherapy.**

**Examples of questions:**

1. The basal metabolic rate (BMR)
   1. Represents the income energy from the food / day.
   2. Represent the maintenance expenditure of energy including beating of the heart, breathing, digestion and growth.
   3. BMR increase with age and sex.
   4. Represent the energy lost by conduction, convection, radiation, evaporation (perspiration).
2. The penetration of a tissues with respect to nuclear radiation

a) is independent on the type of radiation.

b) Is greater for beta particles then alpha particles.

c) Penetration of gamma rays is considerably less then alpha and beta because of low ionising rate.

d) Penetration is relevant only for gamma rays.