

Biophysics Pre-Uni-Study

Program 2017 [10 meetings x (3 h)] = 30 h

Prowadzący: **dr hab. Krzysztof Bryl, prof. UWM**
 mgr Maciej Pyrka

General program:

- Introduction, Test of Competence (verification, discussion).
- Brief repetition of basic physics knowledge – calculation of simple tests.
- Introduction to the University Lectures, Seminars and Laboratory (classes).
Examples of entrance tests.
- Elements of experiments – training in the Laboratory of the Department of Physics and Biophysics.

Introduction to Classes (M1 – M12 - Hand-on experiments):

- M1. Determination of transport number and mobility of ions in electrolytic conductors.
- M2. Ionizing radiation. Determination of linear and mass absorption coefficient of gamma rays for different materials.
- M3. Electrical activity of the heart. Electrocardiography. Determination of the heart's electrical vector.
- M5. The sense of hearing. Measures of auditory threshold.
- M6. Physical principles of ultrasound in medicine. Ultrasonography. Determination of blood pressure.
- M7. Modeling the electrical properties of biological objects. Examination of serial RLC circuit.
- M8. The phenomenon of absorption and emission of light in analysis. Measurement of absorption spectra and the concentration of riboflavin in aqueous solutions using a spectrophotometer. Determination of concentrations of substances in solution using fluorescence.
- M9. Optical rotation of solutions. Measurement of the concentration of optically active substances by using a polarimeter.

M10. Determination of changes of thermodynamic function of state. Determination of changes in the entropy of the system. Determination of enthalpy change in the process of dissolving salt.

M12. Laminar and turbulent flow. Measurement of fluid viscosity.

Introduction to Seminars:

Seminar 1. Chosen problems of biophysics of sensory mechanisms.

P1. Biophysics of photoreception

P2. Implants of vision apparatus – is it possible to repair vision apparatus

P3. Biophysics of chemoreception: smell, taste.

P4. Biophysics of mechanoreception

P5. Biophysics of electroreception

Seminar 2. Molecular biophysics of the cells and tissues.

P6. Molecular spectroscopy in the study of structure and function of macromolecules.

P7. “Classical” optical microscopy.

P8. Confocal microscopy.

P9. Biophysics of neural tissue.

P10. Biophysics of muscular tissue.

Seminar 3. Ionizing radiation in medicine.

P11. Formation of corpuscular and electromagnetic ionising radiation.

P12. Effect of electromagnetic and corpuscular ionising radiation on living organisms.

P13. Dosimetry of ionising radiation. Basics of radiation protection.

P14. Radioisotopes in diagnostics and therapy.

P15. Ionising radiation in diagnostics and therapy.

Seminar 4. Physical basis of selected imaging methods of tissues and organs.

P16. Ultrasound in medicine and biology.

P17. *X-ray transmission computed tomography.*

P18. Nuclear magnetic resonance (NMR) – spectroscopy.

P19. Nuclear magnetic resonance (NMR) – imaging.

P20. *Positron Emission Tomography – Computed Tomography (PET/CT).*

Short introduction to Lectures:

1. Vectors, waves

2. Thermal physics, fluids

3. Optics, vision, implants

4. Nuclear and atomic physics

5. Electricity: electrostatics, electrodynamics

6. The electrical system of the body

7. Sound, hearing, ultrasound

8. The pressure system of the body, the physics of the cardiovascular system

9. Biophysics of sensory mechanisms

10. Physics of diagnostics and therapeutic systems