

Physical foundations of biophysics - elective course

Duration of the course: 2st-13th week

Time: Tuesdays 18:00-20:15 and Thursdays 18:00-20:15

week	date	Title	lecturer	Biophysical analysis and formulas chapter	missing	Location
2	15 Sept, Tuesday 17 Sept, Thursday	Electromagnetic waves, interference, photoelectric effect, matter waves, thermal radiation. Sedimentation, electrophoresis, mass spectroscopy	GV	1. Photoelectric effect	EM waves, matter waves, sedimentation, electrophoresis, mass spectroscopy	LC 0.14.
3	22 Sept, Tuesday 24 Sept, Thursday	Generation and absorption of X-ray, X-ray crystallography. Molecular spectra, Jablonski diagram, fluorescence, fluorescence applications.	FZs	2. Absorption of X-rays and gamma radiation. 3. X-ray crystallography (X-ray diffraction): Interpretation according to Laue and Bragg 4. Absorption photometry	generation of X-rays, fluorescence	LC 0.14.
4	29 Sept, Tuesday 1 Oct, Thursday	Lasers and their application in biology and medicine. Optics, optical microscopy, electron microscopy.	VGy	5. Snell's law 6. Image formation by thin lenses 7. Resolution of the microscope; the electron microscope	lasers	LC 0.14.
5	6 Oct, Tuesday 8 Oct, Thursday	Physical properties of sound, ultrasound. Doppler effect. Medical and biological applications of ultrasound. Nuclear physics. Nuclear binding energy, radioactivity, law of radioactive decay.	BZs	8. Propagation speed of sound 9. Doppler effect 10. Law of radioactive decay 11. Effective, biological and physical decay	ultrasound	LC 0.14.
6	13 Oct, Tuesday 15 Oct, Thursday	Features of nuclear radiation and its interaction with absorbing material. Detection of radiation. Radiation biophysics: target theory, direct and indirect action of radiation. Dosimetry	NE	12. Target theory 13. Indirect action of radiation, plotting on linear or logarithmic scales.		LC 0.14.
7	20 Oct, Tuesday 22 Oct, Thursday	Experimental, diagnostic and therapeutic application of isotopes. Accelerators. Basic principles of nuclear magnetic resonance, NMR spectroscopy in biology and medicine.	NE	15. Basic principles of NMR	isotopes, accelerators	LC 0.14.
8	27 Oct, Tuesday 29 Oct, Thursday	Principles of tomographic methods. X-ray absorption CT. PET. Magnetic resonance imaging (MRI). Gamma camera, SPECT.	GK	14. The concept of density in the interpretation of X-ray absorption	PET, MRI, Gamma camera, SPECT	LC 0.14.
9	3 Nov, Tuesday 5 Nov, Thursday	Chemical potential. Brownian motion. Diffusion at the molecular level, statistical interpretation. Fick's laws. Osmosis. The structure of biological membranes. Membrane transport.	GV	17. Chemical potential 18. Osmosis 19. Diffusion, Fick's laws 20. Diffusion at the microscopic level 21. Measuring diffusion in living cells: Fluorescence recovery after photobleaching 22. Passive transmembrane diffusion: simple and facilitated diffusion		LC 0.14.
10	10 Nov, Tuesday 12 Nov, Thursday	Thermodynamic equilibrium potentials (Nernst, Donnan). Diffusion potential, Goldman-Hodgkin-Katz equation. Ion channels (gating, selectivity), the "patch clamp" technique.	VZ	23. Transport Energetics Across Biological Membranes 24. The electrochemical potential and the direction of ionic current through the membrane 25. Nernst-equation	patch clamp	LC 0.14.
11	17 Nov, Tuesday 19 Nov, Thursday	Resting potential, action potential, and electrical excitability. Measurement of membrane potential. The physical background of ECG and EEG.	HP	26. Donnan-potential 27. Goldman-Hodgkin-Katz equation 28. Essentials of Electrocardiography	resting potential, action potential	LC 0.14.
12	24 Nov, Tuesday 26 Nov, Thursday	The human ear. Mechanism of hearing. The Weber-Fechner law. The human eye. Photoreceptors. The molecular mechanism of vision.	KT	32. The Weber, Fechner, Weber-Fechner- and Stevens laws 33. The bel, phon and sone scales 34. Optics of the eye		LC 0.14.
13	1 Dec, Tuesday 3 Dec, Thursday	Fluid mechanics, blood circulation. Flow cytometry. Confocal laser scanning microscopy.	ZF	29. Equation of continuity 30. Bernoulli-equation 31. Hagen-Poiseuille equation 35. Analysis of flow cytometric data		LC 0.14.

Physical foundations of biophysics (elective course)

The aim of the course is to practice the explain and use of formulas occurring in the biophysics material, which will also help them understand the material and write the SCTs successfully.

Type of the course: seminars and consultation

Requirements of admission: sign up for Biophysics for the same semester

Credit points: 1

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Coordinator: Dr. György Vámosi, Room 1.407, Life Science Bldg.