Biophysics final exam, part I., topic list for the labs (2021, EP)

The form of the exam is a conversation. You will be required to talk about two topics (one from the A-list, and one from the B-list). In each topic you will get two sub-questions (altogether four questions). A perfect answer is 2 points worth, a minimum of 2.5 points must be reached to continue to the theory part.

A/1	Image formation (lens, mirrors), microscope.
A/2	Concentration determination with the refractometer.
A/3	Optics of the eye, image formation in the eye.
A/4	Special microscopy methods.
A/5	Force measurement with a spring/cantilever ; resonance.
A/6	Light emission and its laboratory applications
A/7	Material identification and concentration determination by polarimetry.
A/8	Light absorption and its laboratory applications.
A/9	Basis of nuclear measurement techniques.
A/10	Measurement of the impedance of the skin.
A/11	Ultrasound and its medical applications
A/12	Absorption of gamma radiation, basis of radiation protection.
B/1	Dosimetry, dose(rate) measuring devices.
B/2	Coulter-counter, electronic cell counting.
B/3	Generation of X-ray radiation, absorption of X-ray and basis of X-ray imaging.
B/4	Analysis of the amplifier, signal processing.
B/5	Determination of gamma photon energy, principle of dual isotope labeling.
B/6	Physical basis of ECG.
B/7	Audiometry, determination of the auditory threshold curve and of the audiogram.
B/8	Pulse generators and their applications.
B/9	Imaging by gamma radiation.
B/10	Diffusion and its significance in the human body.
B/11	Fluid flow, the physical basis of blood circulation.
B/12	Sensory function and its modeling.
B/13	Functional principle of the CAT-scan, experiment with the phantom.

Biophysics final exam, part II., topic list for the labs (2021, EP)

The form of the exam is a conversation. After the successful completion of part I. you will be required to talk about two topics (one from the C-list, and one from the D-list). In each topic you will get three sub-questions (altogether six questions). A perfect answer is worth 3 points for each sub-question. The final grade will be given based on the total amount of points from both parts.

C/1	The basis of geometrical optics. What phenomena can be explained by it?
C/2	Absorption of X-ray and γ-radiation, interaction of high energy photons with matter.
C/3	Basis of wave optics. What phenomena can be explained by it?
C/4	Physical properties of water and their explanation.
C/5	Resolution limit of the light microscope, Abbe's principle, special light microscopes.
C/6	Radioactive decay law. Properties and applications of radioactive isotopes.
C/7	How can you apply the wave-particle duality for light?
C/8	Production of X-ray radiation, comparison of bremsstrahlung and characteristic radiation by spectra and generation.
C/9	What quantities and laws can be used to describe radiations?
C/10	Summary of the important experiments about the atomic structure. (Thomson, Rutherford)
C/11	Laws for the description of gases (macro- and microscopic). Real and ideal gases.
C/12	Summary of the Thomson- , Bohr- and Rutherford atomic models with their critiques.
C/13	Spatial and energetic structure of crystalline materials. relation to optical and electric properties.
C/14	Basis of quantum physics (state function). Bound and free states of the electron.
C/15	Luminescence, discrimination of its types, practical applications, spectra.
C/16	Interpretation of bounds and interactions between atoms.
C/17	Structure and properties of liquid crystals, applications.
C/18	The Boltzmann-distribution and its applications.
C/19	Light amplification, properties and generation of laser radiation.
C/20	The Franck-Hertz experiment and its conclusions.
C/21	Defects in crystals, effects of doping.
C/22	Thermal radiation, laws, principles, spectra in different representations.
C/23	Radioactive decay types, interactions of nuclear radiations with matter.
C/24	Light scattering and absorption (macro- and microscopic laws) Interaction of light and matter.
D/1	Flow of fluids (liquids and gases), laws.
D/2	Fluids with internal friction: laws and applications for the blood flow.
D/3	Laws and applications of diffusion in biology.
D/4	Basis of thermodynamics, quantities and concepts used for the description of systems.
D/5	Unified description of transport processes ; The Laws of Thermodynamics.
D/6	Thermodynamic potential functions and their applications.
D/7	Generation of the resting state membrane potential by transport mechanisms.
D/8	Electric potential changes in biological membranes.
D/9	Basis of sensory function, psychophysical laws, connection between stimulus and sensation.
D/10	Basis of sedimentation and electrophoretic methods; application examples.
D/11	Methods based on the absorption of UV and VIS radiation.
D/12	Summary of the nuclear magnetic resonance technique and its applications.
D/13	Structure determination methods based on luminescence.
D/14	Basis of electrical circuits, examples.
D/15	Basis and steps of signal processing methods.
D/16	Medical imaging methods based on the absorption of X-ray radiation.
D/17	Comparison of the medical imaging methods utilizing radioactive isotopes.
D/18	Basis of mass spectrometry.
D/19	Electrical signals used for therapy: generation, applications.
D/20	Operating principle of the FTIR spectrometer and the information gained by its usage.
D/21	Comparison of light end electron microscopes and their applications.
D/22	Application of X-ray diffraction in the structure determination of macromolecules.
D/23	Basis of sonography.
D/24	Particle accelerators, their role in medicine and in the generation of ionizing radiation.