Biophysics final exam, part II., topic list (2022, EP)

The form of the exam is oral. 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).

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, AFM.
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.
C/25	Particle accelerators, their role in medicine and in the generation of ionizing radiation.
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	Detection of ECG signals on the surface of the human body.
D/17	Medical imaging methods based on the absorption of X-ray radiation.
D/18	Comparison of the medical imaging methods utilizing radioactive isotopes.
D/19	Basis of mass spectrometry.
D/20	Electrical signals used for therapy: generation, applications.
D/21	Operating principle and information gained by raster scanning light microscopy.
D/22	Operating principle of the FTIR spectrometer and the information gained by its usage.
D/23	Comparison of light end electron microscopes and their applications.
D/24	Application of X-ray diffraction in the structure determination of macromolecules.
D/25	Basis of sonography.