

Biophysics 2014-15; List of requirements for the exam

Structure of matter: Wave properties of particles, quantum properties of waves; Quantum numbers; Emission, ionization and excitation; Structure of electron shells in atoms; Atomic nucleus; Binding energy in atomic nucleus; Potential barrier of atomic nucleus; Physical principles of mass spectroscopy; Physical principles of nuclear magnetic resonance, Magnetic resonance-Relaxation, MR spectroscopy, Magnetic resonance-Image Formation, Force interactions

Molecular biophysics: International system of units, transformation of units; Phase states of matter; State equation of ideal gas; Kinetic theory of gases, Equipartition theorem, Bernoulli equation, equation of continuity; Law of Laplace; Gibbs's phase rule, phase chart of water; Liquid crystals; Water as solvent; Dispersion systems and their classification; Properties of colloid particles; Dialysis, Principle of electrophoresis, electrokinetic potential; Transport phenomena; Viscosity and its measurement; Diffusion, 1. law of Fick; Surface tension, adsorption; Colligative properties of solutions; Osmotic pressure; Blood pressure measurement, Starling's hypothesis

Thermodynamics: Thermodynamic system, state quantities; First law of thermodynamics; Second law of thermodynamics; Definitions of thermodynamic functions (U, H, S, F, G); Chemical potential; Thermoregulation in organisms; pV diagram; Measurement of temperature; Calorimetric measurements; Specific heat, latent heat;

Physical and physiological acoustics: Physical properties of acoustic waves; Acoustic impedance; Doppler's effect; Sound intensity and loudness, units; Field of hearing; Weber-Fechner's law in acoustics; Ultrasound generators; Physical principles or diagnostic use of ultrasound; Audiometry

Optics in medicine: General classification of electromagnetic waves; Planck's law, Stefan-Boltzmann and Wien laws; Lens equation; Extinction, Lambert-Beer law; Scattering of light; Dispersion of light; Refraction and its use in spectroscopy; Interference and light reflection; Refractometry, Polarimetry; Biophysics of vision; Eye defects; Absorption spectral analysis; Optical properties of colloids; Principle of laser; Optical and electron microscopy;

Electricity in medicine: Coulomb's law, permittivity; Intensity of electric field, Electric current, voltage, resistance, impedance and their measurement, units; Rest membrane potential; Sodium-Potassium Pump; Electrochemical potential; Measurement of el. conductivity in solutions; Action potential and its detection; Action potentials of heart muscle and their detection; Electric current and organism; Use of electricity in diagnostics; Use of electricity in therapy

Use of X-rays in medicine: Production of X-rays, energy spectra; Control of the energy and intensity of X-rays; X-ray apparatus; X-ray absorption; X-ray contrast; Use of X-rays for diagnostic purposes; X-ray therapy; Depth dose; Principle of computed tomography, Roentgen methods, Principle of Computed Tomography; Reconstruction algorithms; CT scanners - principle

Radioactivity and ionising radiation: Radioactive decay; α , β and γ radiation; Radioactive equilibrium; Physical, biological and effective half-life; Absorption of γ radiation; Absorption of α and β radiation; Selective and integral detection of γ radiation; Principles of detection of ionising radiation; Detectors of ionising radiation; Scintillation detector; Geiger-Muller tube; Accelerators of particles; Ionisation chamber; Methods of personal dosimetry; Units of exposition and absorbed dose of irradiation, Gamma camera, Positron emission tomography, Single photon emission tomography

