# MEDICAL BIOPHYSICS
# EXAMINATION QUESTIONS

The basics of processing of results, statistical data processing
The measurement, basic units, signs
Basic particles of matter
Structure of the atom, the atomic nucleus
The structure and properties of molecules
Properties of true solution and suspensions and colloids
The basic properties of water, its function, its distribution within the organism
The importance of ions for cellular functions
Partial pressure of gases and their solubility in liquids – Henry`s Law
Surface tension of liquids
Viscosity

The composition and function of cell membrane
Diffusion across the cell membrane
Diffusion through protein channels
Osmosis and osmotic pressure
Active transport mechanisms
Pasive transport mechanisms

The resting membrane potential
Na+ - K+ and other pumps
The changes of membrane potential, depolarization, hyperpolarization
The formation of generator and action potential
The formation of action potential
The saltatory conduction of action potential
Continuous propagation of action potential
Action potential formation in postsynaptic neurone – integration of PSP
Transmission of action potentials within excitatory synapses
Inhibitory synapses
The law of excitation, strength – duration curve, chronaxy, rheobase
The receptors classification
The relation between stimulus and perception, quality, intensity and location of perception
Adaptation of receptors

Basic thermodynamic terminology
Thermodynamics of living systems
Transformation and accumulation of energy in living systems
The measurement of energy expenditure of the organism
The exchange of heat between body and environment, thermoregulation
Hypothermia, hyperthermia
Thermography
The air humidity and its significance

The gas exchange between inner and outer environment
The mechanics of breathing
Lung compliance and thorax compliance
Airway (respiratory) resistance
Respiratory volumes and capacities
Spirometry
Mechanical work of the heart
Blood flow and mechanical properties of vessels
The measurement of blood and air flows
Blood pressure measurement (direct and indirect methods)
Filtration and resorption in capillaries
Biophysical basics of kidney function
Action potentials of the heart, their formation and propagation, prepotential
ECG recording, ECG leads
The basic shape of ECG curve
Electrical axis of the heart
Brain action potentials, basic EEG rhythms

Biomechanics of locomotion (musculoskeletal system)
Biophysical mechanism of muscle contraction
Excitation-contraction coupling in skeletal muscle
Mechanical and electrical manifestations of muscle contraction, EMG

The basis of sensory perception
Color vision and its defects
Photoreceptors and their functions
Optical system of the eye
The eye accomodation and its function
Emmetropic and ametropic eye and their characteristic
Types eye refractive errors and their corrections
Visual acuity, binocular and spatial vision

The propagation of acoustic signals through outer and middle ear
The reception of accoustic signals in the inner ear
The electrical events in the inner ear
Hearing disorders, their examination and correction

Excitation and ionization potential
Natural and artificial radioactivity
The sources of non-nuclear ionizing radiation
The interaction of alpha, beta and neutron radiations with matter
The interaction of gamma radiation with matter
The methods of detection of ionizing radiation
Basic mechanisms of biological effects of ionizing radiation
Biological effects of nuclear explosions
The protection against ionizing radiation

Physical principles of modern surgical instruments
Physical principles of ionizing radiation therapy
Nuclear Magnetic Resonance Scanning (tomography)

Ultrasound diagnostic methods
Electric therapeutic methods
Thermal therapeutic methods
Radionuclides imaging techniques
Tomography and computer tomography
Fluoroscopy, skiagraphy
Endoscopy
Interaction of light with mass

Light and its characteristic
Microscopy
Electron microscopy

The effects of gravity and acceleration on the body
The effect of negative and positive pressure on the body
The effects of infrasound, audible sound and ultrasound
Biological effects of microwaves
The effects of visible and infrared radiation
The effects of ultraviolet radiation
Magnetic field of organs, the effects of magnetic fields

Electrical current, voltage, resistance
Propagation of electric current in the tissues
Electrical excitability, electric current injuries
Passive electrical properties of tissues

Biological signals
Systems – the terminology and their structure
The properties of dynamic systems
The basics of organ control and regulation
Information, its transmission and processing
Acquisition and recording of electrical signals
The principles of transducers for the recording of non-electric signals
Monitoring and telemetry