**Physiology - Examination Questions - I. Theory**

**A) Body Fluids**

1) Body fluids compartments, measurements and composition
2) Blood - volume (measurement) composition, functions
3) Blood - specific gravity, viscosity, hematocrit
4) Plasma, plasma proteins
5) Red blood cells - composition, count, metabolism, functions
6) Erythrocyte sedimentation rate
7) Hemoglobin
8) White blood cells - count, types
9) White blood cells - functions
10) Immune mechanisms - humoral immunity
11) Immune mechanisms - cellular immunity
12) Hematopoiesis and its regulation
13) Platelets
14) Hemostasis
15) The clotting mechanism - hemocoagulation
16) Fibrinolytic system and anticlotting mechanisms
17) Blood types
18) The Rh group
19) Transfusion - principles
20) Lymph - composition, origin, circulation
21) Ontogenesis - development of blood functions

**B) Cardiovascular Physiology**

1) Physiological properties of the heart
2) Origin and spread of cardiac excitation
3) The electrocardiogram
4) Mechanical properties and metabolism of cardiac muscle
5) The cardiac cycle
6) Heart sounds, phonocardiography
7) Methods for heart examination (in exception of heart sounds evaluation)
8) Cardiac output
9) Regulation of cardiac function
10) Blood flow, velocity and resistance to blood flow
11) Blood pressure
12) Methods for measuring blood pressure, flow and resistance
13) Capillary circulation
14) Venous circulation
15) Regulation of vascular tone
16) Baroreceptors function
17) Cardiovascular reflexes
18) Cerebral circulation, blood flow, regulation
19) The blood brain barrier, cerebrospinal fluid
20) Coronary circulation
21) Splanchnic circulation
22) Circulation in the skin and skeletal muscles
23) Placental and fetal circulation
**C) Respiration**

1) Mechanics of respiration, functions of the respiratory muscles, volumes and capacities
2) Pulmonary and alveolar ventilation. The dead space.
3) Parameters of mechanics of breathing - C, R, W
4) Pulmonary surfactant - composition, biosynthesis, functions
5) Gas exchange in the lungs - principles
6) Pulmonary circulation
7) Oxygen transport in the blood
8) Carbon dioxide transport in the blood
9) Artificial ventilation
10) Oxygen therapy - normobaric and hyperbaric oxygenation
11) Neural control of breathing
12) Chemical control of breathing
13) Lung defense mechanisms and defensive airway reflexes
14) Changes in ventilation during exercise and hypoxia.

**D) Gastrointestinal functions, metabolism and nutrition**

1) Physiology of the mouth, mastication, salivation, saliva
2) Deglutition, swallowing, function of the esophagus
3) Gastric motility and secretion
4) Intestinal motility and secretion
5) Physiology of the colon, defecation
6) Vomiting reflex
7) Function of the exocrine portion of the pancreas
8) Gastrointestinal hormones
9) Liver and biliary system functions
10) Digestion and absorption of carbohydrates
11) Digestion and absorption of proteins
12) Digestion and absorption of lipids
13) Absorption of water, electrolytes, vitamins and minerals
14) Metabolic rate, calorimetry, RQ, factors affecting the met. rate
15) Nutrition - principles and regulation of the food and water intake
16) Vitamins A, D, E, K - source, metabolism, functions
17) Vitamins B, C - source, metabolism, functions
18) Acid-base balance

**E) Renal Functions**

1) Renal circulation - regulation
2) Glomerular filtration
3) Functions of proximal tubules
4) Functions of loops of Henle and distal tubules - the counter current mechanism
5) Regulation of renal functions
6) Filling and emptying of the bladder
F) Endocrinology

1) Hormonal regulation - principles
2) Formation, secretion, transport and metabolism of thyroid hormones
3) Regulation of thyroid secretion and effects of thyroid hormones
4) Endocrine functions of the pancreas
5) Hormones of the adrenal medulla
6) Hormones of the adrenal cortex - glucocorticoids
7) Hormones of the adrenal cortex - mineralocorticoids, androgens and estrogens
8) Hormones of the parathyroid glands
9) Regulation of the Calcium metabolism
10) Hormones of the anterior pituitary gland
11) Pituitary hormones of the posterior lobe
12) Endocrine functions of the testes
13) Ovarian hormones
14) The menstrual cycle
15) Pregnancy, parturition and lactation
16) The renin - angiotensin - aldosterone system.

G) Physiology of skeletal and smooth muscles

1) Skeletal muscle - organization, striations, sarcotubular system, receptors, the motor unit
2) Electrical characteristics of skeletal muscle, ions distribution, action potential, electromyography (EMG)
3) Mechanisms of excitation and contraction, molecular basis of contraction
4) Manifestation of the skeletal muscle activity, electrical, chemical, physical, mechanical
5) Types of muscular contractions, summation of contractions, length - tension relationship, muscle fatigue
6) Energy sources and metabolism for muscle contraction
7) Physiology of smooth muscle
8) Differences between skeletal and smooth muscles (in morphology and in functions)
9) Neuromuscular transmission

H) Thermoregulation

1) Body temperature regulation mechanisms
2) Thermoregulatory reactions in cold and hot environment
3) Physiology of fever
I) Physiology of the Nervous System

1) Resting and action potential of the nerve cells - electrical and ionic basis
2) Nerve fiber types and functions
3) Functional anatomy of synapses, knobs, principles of convergency, divergency
4) Electrical events at synapses (EPSP, IPSP)
5) Inhibition, facilitation, summation and occlusion at synapses
6) Acetylcholine receptors, metabolism of acetylcholine
7) Noradrenergic receptors, biosynthesis and release of catecholamines
8) Neurotransmitters: Dopamine, serotonin, amino acids, glycine, substance P, opioid peptides, adenosine and others
9) Monosynaptic reflexes - function of muscle spindles, gamma system, inverse stretch reflex, muscle tone
10) Polysynaptic reflexes
11) Sensory receptors - classifications, generator potential, adaptation, coding of sensory information, law of projection
12) Cutaneous receptors
13) Pain, receptors, pathways, types
14) Vision - functional anatomy, retina, receptors, visual pathways, visual cortex, lesions in the visual pathways
15) Vision - the image - forming mechanism, accommodation, pupillary reflexes
16) Color vision - mechanisms and theories
17) Hearing - functions of the external and middle ear
18) Hearing - functions of the inner ear, sound waves, transmission and auditory cortex
19) Vestibular functions, nystagmus
20) Physiology of olfaction - receptors, pathways, stimulation, functions, abnormalities
21) Physiology of taste - receptors, pathways, basic modalities, receptor stimulation, functions, abnormalities
22) The functions of reticular formation - ascending and descending systems
23) The electroencephalogram, evoked cortical potentials
24) Sleep - patterns, characterization and distribution of sleep stages
25) Control of posture and movement - corticospinal and corticobulbar system, spinal integration, decerebrate rigidity
26) Control of posture and movement - functions of basal ganglia and cerebellum
27) The autonomic nervous system - organization of autonomic outflow, chemical transmission at autonomic junctions
28) Parasympathetic nervous system - physiological anatomy - functions
29) Sympathetic nervous system - physiological anatomy - functions
30) Responses of effector organs to autonomic nerve impulses
31) Central regulation of visceral functions - medulla oblongata, hypothalamus, etc. psychosomatic relationships
32) Differences between somatic and autonomic reflexes
33) Instinctual behavior and emotions. Limbic functions. Brain chemistry synaptic behavior.
34) Memory - mechanisms, learning
35) Functions of the neocortex
II. Practical Tasks

1) Methods for measurement of hematocrit value
2) The red blood cell count
3) The reticulocyte count
4) Hemolysis
5) Determination of the hemoglobin concentration
6) Calculations of the color index, mean hemoglobin content, concentration and mean red cell volume
7) The white blood cell count
8) Differential white blood cell count
9) Measurement of erythrocyte sedimentation rate
10) Determination of the coagulation time
11) Determination of the bleeding time
12) Measurement of the prothrombine time - Quick´s method
13) Recalcification time
14) The platelet count
15) Determination of blood groups
16) Determination of Rh factor
17) Auscultation of the heart - heart sounds
18) Electrocardiography (ECG) - evaluation of normal ECG
19) Measurement of blood pressure in man
20) Long-term monitoring of the blood pressure by Holter's method
21) Continuous monitoring of peripheral blood pressure by Finometer
22) Effect of Valsalva´s manoeuvre on blood pressure (Burger´s test)
23) Evaluation of the heart rate variability by Varia Pulse system
24) Oculocardiac reflex in man (Ashner´s reflex)
25) Effect of change of posture on cardiovascular system in man - ortho a clinostatic reflexes (mechanisms, assessment methods)
26) Effect of increased intrathoracic pressure (Valsalva´s manoeuvre) on heart rate (mechanisms, assessment methods)
27) Evaluation of respiratory sinus arrhythmia by deep breathing test (mechanisms, assessment methods)
28) Effect of an exercise on heart rate and blood pressure in man
29) Blood pressure changes in „cold stress“ test
30) Measurement of blood velocity by ultrasound
31) Auscultation of the lung sounds
32) Pulmonary function tests - spirometry
33) Evaluation of the forced expiratory spirogram (FEV1, FVC ...)
34) Measurement of the nasopharyngeal ciliary transport in man
35) Measurement of the oxygen consumption, determination of the ventilation equivalent and the oxygen utilisation coefficient
36) Gas analysis of the expiratory air by oxymeter and capnograph
37) Determination of the PaO2, PaCO2 and pH in the capillary blood - Astrup´s method
38) Measurement of the airway resistance (Raw)
39) Measurement of oxygen saturation of hemoglobin by pulse oximetry
40) Assessment of surfactant quality by capillary surfactometer
41) Chemical control of breathing
42) Demonstration of ptyalin activity in saliva
43) Measurement of the swallowing time
44) Examination of the composition of the gastric juice - free and total acidity
45) Measurement of the basal metabolic rate
46) Measurement of the metabolic rate during work
47) Measurement of glycaemia
48) Anthropometric measurements and indexes
49) Renal function tests
50) Investigation of urine by diagnostic test strips
51) Microscopic investigation of urinary sediment
52) The muscle elasticity, direct and indirect stimulation of the muscle,
stimuli, threshold, overthreshold and maximal muscle twitch.
53) Myographic curve, superposition and summation of the muscle contraction, complete
and incomplete tetanus
54) Measurement of the muscle strength in man; muscle fatigue.
55) Examination of some somatic reflexes in humans
56) Ophthalmoscopy
57) Pupillary and pupillary accommodation reflexes; photostress test
58) Examination of the field of vision
60) Rinne’s, Weber’s and Schwabach’s tests
61) Otoscopy
62) Evaluation of smell perception; rhinoscopy
63) Taste perception
64) Investigation of skin sensitivity; Space perception by tactile sense and stereognosis