

Physiology: spring semester 2013/2014

Part A

1. Structure and function of cell membranes and cell organelles
2. Passive transport across membranes. Co-transport
3. Compartmentalization of body fluids
4. Differences between intra- and extracellular fluids
5. Production and resorption of interstitial fluid (Starling forces)
6. Ion channels
7. Intercellular communication
8. Functions of the nerve cell
9. Functional morphology of synapses
10. Synthesis and break down of transmitters
11. Generation of resting membrane potential
12. Local response of membrane potential
13. Action potential
14. Excitability and refractoriness
15. Excitation-contraction coupling
16. Molecular mechanism of muscle contraction
17. Electrical and mechanical behaviour of skeletal muscle
18. Electrical and mechanical behaviour of smooth muscle
19. Electrical and mechanical behaviour of cardiac muscle
20. Isometric and isotonic contraction. Length-tension relation.
21. Neuromuscular junction
22. Energy production and conservation
23. Caloric content of food. Direct calorimetry. Energy balance. Indirect calorimetry.
24. Physiological role of calcium
25. Vitamins – overview
26. Hypovitaminoses and hypervitaminoses
27. Basal metabolism
28. Hypoxia and ischemia
29. Physiological applications of law of Laplace
30. Lung ventilation, volumes, measurement. Dead space.
31. Maximal respiratory flow – volume curve (spirogram)
32. Respiratory quotient
33. Cardiopulmonary response to exercise
34. Sympathetic alpha- and beta-receptors
35. Physiological significance of positive and negative feed-back
36. Physiological regulations (overview)
37. Homeostasis
38. Functional morphology of nephron
39. Urine formation
40. Renal blood flow and its autoregulation
41. Glomerular filtration
42. Function of renal tubules
43. Juxtaglomerular apparatus
44. Renal sodium transport, aldosteron
45. Passive transport in kidneys
46. Transport of glucose in kidneys
47. Urea formation
48. Hyper- and hypotonic urine. Counter-current system.
49. Osmotic and water diuresis
50. Acid-base balance
51. Acid-base balance determined by the acid-base nomogram (relationship between pH, pCO₂ and HCO³⁻)
52. Clearance

53. Regulation of renal functions
54. Micturition
55. Regulation of constant pH
56. Kidney in regulation of homeostasis
57. Intrapulmonary and pleural pressure. Pneumothorax.
58. Alveolar surface tension. Surfactant.
59. Composition of atmospheric and alveolar air.
60. Gas exchange in lungs and tissues
61. Transport of O₂. Oxygen – haemoglobin dissociation curve.
62. Transport of CO₂
63. Regulation of ventilation
64. Respiratory responses to irritants
65. Formation, composition and functions of saliva
66. Gastric production of HCl
67. Functions of the stomach
68. Motility of gastrointestinal tract
69. Regulation of gastric and pancreatic secretion
70. Co-ordination of GIT segments
71. Composition and function of pancreatic juice
72. Liver functions
73. Formation, composition and functions of bile
74. Digestion in the small intestine
75. Functions of colon
76. Resorption of lipids, minerals and water in small intestine
77. Intermediary metabolism (overview). Nitrogen balance
78. Metabolism of cholesterol. Atherosclerosis.
79. Metabolism of iron
80. Thermoregulation
81. Sympathetic nervous system (overview)
82. Parasympathetic nervous system (overview)
83. Integration of nervous and hormonal regulation
84. Regulation and adaptation

Part B

1. Blood composition – values
2. Red blood cell. Haemolysis.
3. Haemoglobin and its derivatives
4. Suspension stability of RBC (sedimentation rate)
5. Cellular immunity
6. Humoural immunity
7. Complement system
8. Blood groups antigens (ABO group, Rh group)
9. Function of platelets
10. Hemocoagulation
11. Anticlotting mechanism
12. Conduction system of the heart
13. Cardiac automaticity
14. Spread and retreat of excitation wavefront
15. Cardiovascular response to haemorrhage
16. Cardiovascular reflexes (Valsalva maneuver, Muller maneuver, diving reflex)
17. Invasive assessment of blood pressure
18. Non-invasive assessment of blood pressure
19. Measurement of cardiac output and blood flow
20. ECG leads
21. ECG record in different leads
22. Estimation of electric axis of the heart
23. Cardiac contractility and its determination
24. Ejection fraction, heart failure
25. Polygraphic recording of one cardiac cycle (ECG, phonocardiogram, , aortic pressure, left ventricular pressure, left ventricular volume)
26. Specific features of cardiac metabolism

27. Heart as a pump
28. Differences between left and right heart
29. Determinants of cardiac performance: preload, afterload, inotropy
30. Cardiac reserve. Heart failure.
31. Cardiac cycle. Phases. Pressure-volume loop.
32. Stroke volume and cardiac output
33. Heart sounds. Diagnostic significance.
34. Starling principle (heterometric autoregulation of cardiac contraction)
35. Frequency effect (homeometric autoregulation of cardiac contraction)
36. Heart rate
37. Regulation of cardiac output
38. Overview of arrhythmias
39. Coronary circulation
40. Coronary reserve. Ischaemic heart disease.
41. Cardiovascular system – general principles
42. Vascular resistance
43. Blood pressure. Hypertension.
44. Arterial elasticity – significance
45. Arterial pulse wave
46. Physiological role of endothelium
47. Vasoactive substances
48. Micro-circulation
49. Venous pressure
50. Venous return. Venous stasis and embolism.
51. Lymphatic system
52. Pulmonary circulation
53. Cerebral circulation
54. Skin circulation
55. Muscle and splanchnic circulation
56. Regulation of blood circulation upon orthostasis
57. Placental and foetal circulation. Circulatory adjustments at birth
58. Autocrine, paracrine, endocrine regulation
59. General principles of endocrine regulation
60. Chemical characteristics of hormones
61. Examination methods in endocrinology (RIA, enzyme-immuno-analysis)
62. Effect of hormones on target cells
63. Second messengers
64. Hypothalamo-pituitary system
65. Hypothalamic releasing hormones
66. Glandotropic hormones of anterior pituitary gland
67. Growth hormone and growth factors (IGF)
68. Formation and secretion of posterior pituitary hormones
69. Effects of thyroid hormones
70. Metabolism of iodine; Thyroid hormones synthesis
71. Hyper- and hypothyroidism
72. Endocrine pancreas
73. Insulin – mechanism of action
74. Glycaemia
75. Hyper- and hypoglycaemia. Diabetes mellitus.
76. Adrenal cortex. Functions, malfunctions.
77. Metabolic and anti-inflammatory effects of glucocorticoids
78. Adrenal medulla. Synthesis of catecholamines.
79. Parathormone
80. Vitamin D and calcitonin
81. Antidiuretic hormone. Natriuretic peptides
82. Pineal gland. Circadian rhythm.
83. Puberty and menopause
84. Ovarian cycle and its control
85. Uterine cycle
86. Physiology of pregnancy
87. Physiology of parturition and lactation
88. Hormonal contraception
89. Endocrine functions of testes
90. Regulation of body fluid volume
91. Regulation of constant osmotic pressure
92. Regulation of calcium metabolism
93. Regulation of glycaemia
94. Regulation of adrenal cortex