

Physiology: spring semester 2016

Part A

1. Structure and function of cell membranes and cell organelles
2. Transport across cell membranes
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. Generation of resting membrane potential
11. Local response of membrane potential
12. Action potential
13. Excitability and refractoriness
14. Excitation-contraction coupling
15. Molecular mechanism of muscle contraction
16. Electrical and mechanical behaviour of various types of muscle
17. Isometric and isotonic contraction. Length-tension relation.
18. Neuromuscular junction
19. Temporal and space summation (summation and recruitment) in skeletal muscle
20. Energy metabolism and its measurement
21. Physiological role of calcium
22. Vitamins
23. Regulating of food intake and its disorders
24. Hypoxia and ischemia
25. Heat production and heat loss, thermoregulation
26. Physiological applications of law of Laplace
27. Registration of membrane potentials and currents
28. Lung ventilation, volumes, measurement
29. Dead space, measurement
30. Resistance of airways, measurement
31. Maximal respiratory flow – volume curve (spirogram)
32. Respiratory quotient
33. Cardiopulmonary response to exercise
34. Physiological significance of positive and negative feed-back
35. Physiological regulations (overview)
36. Homeostasis
37. Functional morphology of nephron
38. Tubular processes, tubular reabsorption and secretion, urine formation
39. Renal blood flow and its autoregulation
40. Glomerular filtration, principals and regulation, juxtaglomerular apparatus
41. Renal sodium, potassium, chloride transports, their regulation
42. Urea formation
43. Water resorption, hyper- and hypotonic urine. Counter-current system.
44. Osmotic, water and pressure diuresis
45. Examination of renal function. Clearance.
46. Micturition
47. Metabolic and endocrine renal function
48. Kidney in regulation of homeostasis
49. Alveolar surface tension. Surfactant.
50. Compliance of lungs. Respiratory work. Pneumothorax.
51. Composition of atmospheric and alveolar air. Gas exchange in lungs and tissues
52. Transport of O₂. Oxygen – haemoglobin dissociation curve. Transport of CO₂
53. Herring-Breuer reflexes
54. Regulation of ventilation
55. Respiratory responses to irritants
56. Formation, composition, functions and regulation of saliva
57. Formation, composition, functions and regulation of gastric secretion
58. Functions of the stomach
59. Formation, composition, functions and regulation of pancreatic juice
60. Motility of gastrointestinal tract
61. Co-ordination of GIT segments
62. Liver functions
63. Formation, composition, functions and regulation of bile
64. Digestion and resorption in the small intestine
65. Functions of colon
66. Sympathetic nervous system (overview)
67. Parasympathetic nervous system (overview)
68. Adaptation to extreme environmental conditions
69. Adaptation to exercise, athlete's heart
70. Integration of nervous and hormonal regulation
71. Regulation and adaptation

Part B

1. Blood composition – values
2. Red blood cell. Haemolysis.
3. Haemoglobin and its derivatives. Metabolism of iron.
4. Erythropoietin and erythropoiesis
5. Suspension stability of RBC (sedimentation rate)
6. Mechanism of innate immunity
7. Acquired immunity
8. Blood types
9. Function of platelets
10. Hemocoagulation
11. Anticlotting mechanism, fibrinolytic system
12. Conduction system of the heart
13. Cardiac automaticity
14. Spread and retreat of excitation wavefront. Electric vector of the heart.
15. Examination of heart rate and blood pressure variability. Examination of baroreflex sensitivity
16. Special methods of ECG and blood pressure examination (vectocardiography, 24-hour-monitoring)
17. Cardiovascular response to haemorrhage
18. Cardiovascular reflexes (Valsalva maneuver, Muller maneuver, diving reflex)
19. Invasive assessment of blood pressure
20. Non-invasive assessment of blood pressure
21. Cardiac output and its measurement
22. Measurement of blood flow
23. ECG leads. ECG record in different leads
24. Estimation of electric axis of the heart
25. Cardiac contractility and its determination
26. Polygraphic recording of one cardiac cycle (ECG, phonocardiogram, aortic pressure, left ventricular pressure, left ventricular volume)
27. Specific features of cardiac metabolism
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. Heart sounds. Diagnostic significance.
33. Starling principle (heterometric autoregulation of cardiac contraction)
34. Frequency effect (homeometric autoregulation of cardiac contraction)
35. Heart rate
36. Regulation of heart functions
37. Overview of arrhythmias
38. Coronary circulation. Coronary reserve. Ischaemic heart disease.
39. Cardiovascular system – general principles
40. Significance of Poiseuille-Hagen formula for blood flow
41. Vascular resistance in various parts of circulation
42. Blood pressure. Hypertension.
43. Arterial elasticity – significance
44. Arterial pulse wave
45. Physiological role of endothelium
46. Vasoactive substances
47. Micro-circulation
48. Venous pressure
49. Venous return. Venous stasis and embolism.
50. Lymphatic system
51. Pulmonary circulation
52. Cerebral circulation
53. Skin circulation
54. Muscle and splanchnic circulation
55. Regulation of blood circulation upon orthostasis
56. Placental and foetal circulation. Circulatory adjustments at birth
57. Autocrine, paracrine, endocrine regulation
58. General principles of endocrine regulation
59. Chemical characteristics of hormones
60. Effect of hormones on target cells
61. Second messengers
62. Up- and down-regulation of receptors
63. Hypothalamo-pituitary system
64. Prolactin
65. Glandotropic hormones of anterior pituitary gland
66. Growth hormone and growth factors (IGF)
67. Formation and secretion of posterior pituitary hormones
68. Thyroid hormones. Regulation and dysregulation.
69. Endocrine pancreas
70. Insulin and mechanism of its action
71. Glycaemia, its regulation and dysregulation
72. Adrenal cortex. Functions, malfunctions.
73. Metabolic and anti-inflammatory effects of glucocorticoids
74. Adrenal medulla. Synthesis and degradation of catecholamines.
75. Bone formation and resorption. Regulation of calcaemia.
76. Natriuretic peptides
77. Endogenous opioid system
78. Pineal gland. Circadian rhythm.
79. Puberty and menopause
80. Cyclic changes in non-pregnant women
81. Physiology of pregnancy
82. Physiology of parturition
83. Physiology of lactation
84. Hormonal contraception – the principals
85. Endocrine functions of testes, its regulation
86. Regulation of body fluid volume
87. Regulation of constant osmotic pressure