

## Physiology:

### 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. Synthesis and break down of transmitters. Local response of membrane potential
10. Generation of resting membrane potential
11. Action potential
12. Excitability and refractoriness
13. Excitation-contraction coupling. Neuromuscular junction
14. Molecular mechanism of muscle contraction
15. Electrical and mechanical behaviour of skeletal, smooth and cardiac muscle
16. Isometric and isotonic contraction. Length-tension relation.
17. Caloric content of food. Direct calorimetry. Energy balance. Indirect calorimetry.
18. Physiological role of calcium
19. Vitamins – overview
20. Hypovitaminoses and hypervitaminoses
21. Basal metabolism. Respiratory quotient
22. Hypoxia and ischemia
23. Physiological applications of law of Laplace
24. Lung ventilation, volumes, measurement. Dead space.
25. Maximal respiratory flow – volume curve (spirogram)
26. Cardiopulmonary response to exercise
27. Sympathetic alpha- and beta-receptors
28. Physiological significance of positive and negative feed-back
29. Physiological regulations (overview)
30. Homeostasis
31. Functional morphology of nephron
32. Renal blood flow and its autoregulation. Regulation of renal functions
33. Glomerular filtration. Clearance
34. Function of renal tubules
35. Juxtaglomerular apparatus
36. Renal sodium transport, aldosterone
37. Passive transport in kidneys
38. Transport of glucose in kidneys
39. Urea formation
40. Hyper- and hypotonic urine. Counter-current system. Urine formation.
41. Osmotic and water diuresis
42. Acid-base balance and its evaluation by the acid-base nomogram (relationship between pH,  $p\text{CO}_2$  and  $\text{HCO}_3^-$ )
43. Micturition
44. Regulation of constant pH
45. Kidney in regulation of homeostasis
46. Intrapulmonary and pleural pressure. Pneumothorax.
47. Alveolar surface tension. Surfactant.
48. Composition of atmospheric and alveolar air.
49. Gas exchange in lungs and tissues

50. Transport of  $\text{O}_2$ . Oxygen – haemoglobin dissociation curve.
51. Transport of  $\text{CO}_2$
52. Regulation of ventilation
53. Respiratory responses to irritants
54. Formation, composition and functions of saliva
55. Gastric production of HCl
56. Functions of the stomach
57. Motility of gastrointestinal tract
58. Regulation of gastric and pancreatic secretion
59. Co-ordination of GIT segments
60. Composition and function of pancreatic juice
61. Liver functions
62. Formation, composition and functions of bile
63. Digestion in the small intestine
64. Functions of colon
65. Resorption of lipids, minerals and water in small intestine
66. Intermediary metabolism (overview). Nitrogen balance
67. Metabolism of cholesterol. Atherosclerosis.
68. Metabolism of iron
69. Thermoregulation
70. Sympathetic and parasympathetic nervous system (overview)
71. Integration of nervous and hormonal regulation
72. 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 (specific and nonspecific)
6. Humoural immunity (specific and nonspecific)
7. Blood groups antigens (ABO group, Rh group)
8. Function of platelets
9. Hemocoagulation
10. Anticlotting mechanism
11. Conduction system of the heart
12. Cardiac automaticity
13. Spread and retreat of excitation wavefront
14. Cardiovascular response to haemorrhage
15. Cardiovascular reflexes (Valsalva maneuver, Muller maneuver, diving reflex)
16. Invasive assessment of blood pressure
17. Non-invasive assessment of blood pressure
18. Measurement of cardiac output and blood flow
19. ECG leads. ECG record in different leads
20. Estimation of electric axis of the heart
21. Cardiac contractility and its determination
22. Ejection fraction, heart failure
23. Polygraphic recording of one cardiac cycle (ECG, phonocardiogram, , aortic pressure, left ventricular pressure, left ventricular volume)
24. Heart as a pump
25. Differences between left and right heart
26. Determinants of cardiac performance: preload, afterload, inotropy
27. Cardiac reserve. Heart failure.
28. Cardiac cycle. Phases. Pressure-volume loop.
29. Stroke volume and cardiac output
30. Heart sounds. Diagnostic significance.
31. Autoregulation of cardiac contraction: Starling principle (heterometric type), frequency effect (homeometric type)
32. Heart rate

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