

1. The purpose of the discipline to form students' systematic knowledge of the vital activity of the whole organism and its individual parts, the basic laws of functioning and mechanisms of their regulation in their interaction with each other and with the factors of the external environment.

2. Objectives of the discipline:

- able and willing to use basic scientific concepts and methods to analyze the anatomical and physiological characteristics of healthy body systems in solving professional problems;
- able and ready to analyze the basic laws underlying the processes occurring in the human body, their physiological essence and regulation mechanisms; physiological basis of the methods of research of body functions in solving professional tasks
- able and able to measure the most important indicators of human vital functions at rest and under load:
- able and willing to evaluate the results of electrocardiography, electroencephalography, spirometry, thermometry, blood and urine tests; use simple medical instruments (phonendoscope, neurological hammer, tonometer, thermometer, perimeter).
- able and willing to use scientific research methods in the field of human physiology, safety rules of work in physiological laboratories; able to formulate tasks, conduct analysis and statistical processing of data; skilled in information search and abstracting from various sources in the professional sphere.

3. As a result of mastering the discipline, the student must:

Know:

- basic laws of development and vital activity of the organism based on the structural organization of cells, tissues and organs
- physico-chemical essence of processes taking place in living organism on molecular, cellular, tissue and organ levels
- human body functional systems, their regulation and self-regulation under influence of external environment in norm and pathology.

Be able to:

- interpret the results of the most common functional diagnostic methods used to detect pathologies of blood, heart and blood vessels, lungs, kidneys, liver and other organs and systems
- Give a histophysiological assessment of the state of various cellular, tissue and organ structures

Own:

- simple medical instruments (phonendoscope, neurological mallet, scalpel, tweezers)
- medical-anatomical conceptual apparatus

4. Prerequisites: BP¹: Latin, MEN: chemistry, biophysics, SPD: molecular biology and medical genetics, medical biology, normal anatomy

5. Post requisites: Pathophysiology. Pharmacology. Patanatomy. Clinical disciplines. Pediatrics. Infectious diseases

6. Technological map of discipline in 1 semester

modules	total		lectures		Practical cl.		SIW		TC	FC	Points
	Aud	SIW	hour	points	hour	points	hour	points			
I	30	30	12	30	36	30	30	30	30		
II	30	30	12	30	36	30	30	30	30		
total	120		24	60	72	60	60	60	60	40	100

7. Map of points accumulation for the subject “Human Physiology 1” in the context of module (2nd semester, 2022-2023 academic year, specialty: 560001-general medicine “GM”)

№	Name of groups	Average point of current TC	Lecture	SIW	CW	Total
	First name/ last name of stud	30 points	30 points	30 points	30 points	60 points
1.						
2.						

$$\text{Module} = \frac{\text{Module test} + \text{Avrge of Pract} (\text{Avrge of pr.cl.} + L + \text{SIW};)}{2 \quad 3}$$

¹ Basic Programme of MBBS

Technological map of the accumulation of points of the group _____
(Discipline: "Human physiology 1", specialty: 560001- general medicine (GM), 2-semester, 2022-2023 academic year)

CLASS №1		Topic №__ Cardiovascular system						
№	I-week	Class attendance	Copybook	Activity	Test		total	Date of rework
	First name/last name	5	5	10	10		30	
1.								
...								

7. Calendar-thematic plan of lecture classes for MBBS students - 560001
(2nd semester, 2022-2023 academic year.)

№ week	№ class	Name of sections, modules and topics	Hours
1.	1	Basic concepts and principles of normal physiology. Physiology of excitable tissues.	2 h.
2.	2	Physiology of neurons and synapses. Introduction to NS.	2 h.
3.	3	Physiology of contractile elements.	2 h.
4.	4	Neurophysiology of the CNS. Physiology of spinal cord. Reflex, reflex arc.	2 h.
5.	5	Physiology of brainstem (medulla, pons, midbrain). Ph. of cerebellum.	2 h.
6.	6	Brain cortex. Ph. Of ANS	2 h.
8 week		1 module: " Physiology of excitable tissues and NS "	2 h.
7.	7	Endocrine system, and its regulation	2 h.
9.	8	Physiology of endocrine glands	2 h.
10.	9	Physiology of special senses and pain	2 h.
11.	10	Physiology of vision, hearing and balance and chemical senses	2 h.
12.	11	Physiology of higher nervous activity, and intellectual functions	2 h.
13.	12	States of brain activity, sleep and wakefulness.	2 h.
16		2 module: " Physiology of Endocrine system and HNA "	2 h.
Total	Lectures		24 ч
	Practical		36 ч

8. Calendaric-thematic plan of practical classes
for MBBS students - 560001
(2nd semester, 2022 -2023 academic year)

№	№	Name of sections, modules and topics	Hours
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week	class		
1. week	1	Basic concepts and principles of normal physiology.	2 h.
2. week	2	Physiology of excitable tissues.	2 h.
3. week	3	Introduction to the NS. Physiology of neurons and synapses.	2 h.
4. week	4	Physiology of contractile elements.	2 h.
5. week	5	Neurophysiology of the CNS. Physiology of spinal cord. Reflex, reflex arc.	2 h.
6. week	6	Physiology of brainstem (medulla, pons, midbrain).	2 h.
7. week	7	Physiology of cerebellum.	2 h.
8. week	8	Brain cortex.	2 h.
8 week	8	1 module : " Physiology of excitable tissues and NS "	16 h.
9. week	9	Physiology of ANS	2 h.
10. week	10	Physiology of the endocrine glands I..	2 h.
11. week	11	Physiology of endocrine glands II.	2 h.
12. week	12	The endocrine system and its regulation.	2 h.
13. week	13	Introduction to the physiology of sensory systems. Pain sensitivity and chemical analyzers.	3 h.
14. week	14	Physiology of hearing, balance. Physiology of vision	3 h.
15. week	15	Physiology of higher nervous activity I. Thinking and consciousness. Alarm systems. Speech functions. Speech functions of the hemispheres. Unconditional reflexes.	3 h.
16. week	16	Physiology of higher nervous activity II. Memory and emotions. Biorhythms. Sleep and wakefulness.	3 h.
16. week	16	2 module : " Physiology of Endocrine system and HNA "	20 h
Total			36 h

8. Students individual work (SIW)

№	Topics	Hours
1	Introduction. Basic concepts of normal physiology	3h
2	Local potentials	3h
3	Physiology of nerve fibers and synaptic transmission.	3h
4	Principles of muscular activity control. Indicators of muscle physical activity.	3h
5	Structural and functional characteristics of smooth muscles.	3h
6	Physiological systems ensuring the constancy of the most important blood constants	3h
7	General physiology of CNS.	3h
8	Physiology of the spinal cord. Physiology of the brain stem.	3h
9	Methods of investigation of the central nervous system.	3h
10	Autonomic nervous system.	3h
11	Functional zones of the cerebral cortex.	3h
12	The general principle of operation of the analyzers.	3h
13	Auditory and vestibular analyzers.	3h
14	Pain. Nociceptive analyzer.	3h
15	Regulation of hormone production.	3h
16	Renin angiotensin system.	3h
17	Methods for studying the functions of endocrine glands.	3h
18	Memory.	3h
19	Asymmetry of the hemispheres.	3h
20	Conditioned and unconditioned reflexes	3h
	total	60 hours

10. Educational technology

With a competency-based approach in education, the main factor in educational activity is not so much the component of knowledge acquisition as the component of the acquisition by students of various methods of activity for solving the set educational tasks. Therefore, to achieve the expected learning outcomes of the discipline, it is necessary to use various new technologies and interactive methods.

Interactive learning is first of all dialogue learning, during which there is an interaction between the student and the teacher, and between the students themselves. Interactive methods contribute to the formation of competencies and the achievement of certain learning outcomes - the acquisition of knowledge, the formation of skills.

lecture-visualization (LP), problem lecture (PL), mini-lecture (ML), lecture - press conference (LPC), lesson - conference (LC), brainstorming (BS), master class (MC), business and role-playing educational game (BG, REG), the method of small groups (SG), participation in scientific and practical conferences (SPC), student research and development work (SRDW), subject Olympiads (O), preparation and defense of abstracts (R), Tests (T), situational tasks (ST), interactive whiteboard (IW), handouts (H), videos (V), slides (S), multimedia presentation (MPres), assignments for independent work, teamwork (TW), research method (RM).

12. Educational-methodical and informational support of discipline

Main Literature:

1. Arthur C. Guyton, John Edward Hall Textbook of Medical Physiology. - 11th edition. - University of California: Elsevier Saunders, 2006. - 1116 c.

2.K. Sembulingam, Prema Sembulingam-Essentials of Medical Physiology - 6th edition. - Jaypee Brothers Medical Publishers (P) Ltd, 2012. - 1092 p. - ISBN-10: 9350259362. - ISBN-13: 978-9350259368.

Additional literature.

1. Ganong's Review of Medical Physiology 25th Edition / Kim E. Barrett, Susan M. Barman, Scott Boitano, and Heddwen Brooks, 25th ed. - CA: McGraw Hill Professional, 2015. - 768 c.

2. Cindy L. Stanfield Principles of Human Physiology, Global Edition. - 6th ed. Pearson Education Limited, 2016. - 816 c.

3. n. Geetha Practical Physiology. - Jaypee: Jaypee, 2017. - 393 c.

13. The politics of pointing

100 point system	30 point system	Points	Mark	Traditional
87 – 100	26 – 30	A	4,0	Excellent
80 – 86	24 – 25	B	3,33	Good
74 – 79	22 – 23	C	3,0	
68 -73	20 – 21	D	2,33	Satisfactory
61 – 67	18 – 19	E	2,0	
31-60	9 – 17	FX	0	Unsatisfactory
0-30	0 – 8	X	0	-

14. Questions for modules in Human physiology 1

1. Physiology as a science, definition
2. History of development of physiology.
3. Purpose, objectives, subject of physiology.
4. Relationship of human physiology to other disciplines.
5. Sections of physiology.
6. Mechanisms of regulation of body functions.
7. Principles of self-regulation. The concept of homeostasis.
8. Research methods used in physiology.
9. The concept of irritability. Types of stimuli.
10. Biological membranes, definition, functions.
11. Structure of biomembranes and functions of their components.
12. Properties of cell membranes.
13. Transport of substances through membranes, significance.

14. Types of substance transport.
15. Passive transport, types and characteristics
16. Active transport, types and characteristic.
17. Concept of excitability and excitation.
18. Measures of excitability.
19. Concept of bioelectrical potentials. Types of potentials.
20. Resting membrane potential, definition, magnitude, mechanism of its formation.
21. Action potential, definition, magnitude, mechanism of their formation.
22. Action potential graph, its components.
23. Ion pumps, their role in providing bioelectric processes in tissues.
24. Change in excitability during excitation, its phases.
25. Nervous system, definition, classification.
26. Functions of the nervous system.
27. Cells of the nervous system.
28. Neuron, structure, classification, functions.
29. Neuroglia, types, functions.
30. Nerve fibers, structure and functions of structural elements.
31. Classification and mechanism of conduction of excitation through nerve fibers.
32. Synapse, structure and classification.
33. Mediators, their characteristics.
34. Stages and mechanisms of synaptic transmission of excitation.
35. Basic properties of synapses.
36. Central synapses, types, properties.
37. Muscle Physiology. Types of muscles.
38. Functions of muscles.
39. Classification of skeletal muscle.
40. Macro-, micro-, ultrastructure of skeletal muscle.
41. Properties of skeletal muscle.
42. Mechanism of contraction and relaxation of muscle.
43. Types of muscle contractions.
44. Modes of muscle contraction.
45. Work and power of a muscle.
46. Smooth muscles. Properties of smooth muscles.
47. Comparative characteristics of physiological properties of skeletal and smooth muscles.
48. History of the development of the reflex theory. The importance of works of R. Descartes, I. Prochazk, I.M. Sechenov, I.P. Pavlov, C. Sherrington.
49. Basic principles of the reflexive theory. Structure of the reflexive arc.
50. Classification of reflexes. Differences between the reflexive arc of vegetative and and somatic reflexes.
51. Properties of reflexes.
52. The spinal cord. Principles of segmental innervation.
53. Segmentary and intersegmentary principles of the spinal cord. Functions of the anterior and posterior roots. Bell-Majandi law. Neurons of the spinal cord: α -, γ -motoneurons, interneurons, afferent neurons. Their role.
54. Conductive functions of the spinal cord. Conduction pathways of the spinal cord (ascending and descending pathways).
55. Characteristics of spinal animals. Spinal shock. Clinically important. Spinal reflexes.
56. The midbrain. The role of the midbrain in the processes of self-regulation of functions.
57. Reflex activity of the midbrain. Neural organization.
58. Functions of the quadriplegic, red nuclei, black matter, nuclei of III, IV pairs of cranial nerves, bluetongue, central gray circumferential matter.

59. Participation of the midbrain in phasic-tonic activity of muscles. Setting reflexes: static and statokinetic (R. Magnus).
60. Mechanism of maintaining body balance.
61. Conductive function of the midbrain.
62. Neural organization of the reticular formation of the brainstem. Properties of the neurons of the reticular formation.
63. Functions of the reticular formation.
64. The intermediate brain and its functions.
65. Functions of the bridge.
66. Cerebellum. Structure and functions.
67. Neural organization. Afferent and efferent connections of cerebellum.
68. Corrective and stabilizing influences of the cerebellum on motor function.
69. Participation of the cerebellum in the organization of voluntary and involuntary motor programs.
70. Symptoms of cerebellar lesions
71. Consequences of lesions of various cerebellar areas.
72. The cerebral cortex. Morphofunctional features. The neural organization. Columnar organization of the cortex. Functions of the ancient, old and new cortex.
73. Limbic system, functions of limbic system.
74. Dynamic localization of functions in the large hemisphere cortex. Sensory areas of the cortex.
75. Efferent (motor) areas of the cortex.
76. Associative areas of the cortex.
77. Irradiation and convergence of excitations of different modality in the cortex. The role of inhibitory neurons in analytic and synthetic cortical activity. Plasticity of the cortex (E.A. Asratyan).
78. Cortico-subcortical and cortico-visceral relationships.
79. The role of the cortex in formation of systemic activity of the organism. Paired cortical activity of the large hemispheres. Functional asymmetry of the cortex in humans. Dominance of hemispheres.
80. Body schema. Static and dynamic body image. Locomotion control, role of motor program generators, "command neurons". Arbitrary movements: the functional blocks of their organization. Working movements, postures, development of motor skills.
81. Functions of the endocrine system.
82. Functional significance of hormones.
83. Functional classification of hormones.
84. Mechanisms of hormone synthesis, secretion, blood transport and destruction.
85. General principles of endocrine pathology.
86. General mechanisms of hormone action at the cellular level (interaction with membrane receptors, cytosolic receptors, nucleus.)
87. Secondary mediators and their role.
88. Mechanisms of hormonal regulation of physiological functions.
89. Peculiarities of hormone regulation in comparison with nervous regulation. Direct and reverse systems (positive and negative) connections.
90. Methods to study the endocrine system.
91. Hypothalamic-pituitary system. Its functional organization.
92. Neurosecretory cells of hypothalamus. Characteristics of tropic hormones and Riling hormones (liberins, statins). Hormones of epiphysis.
93. Adenohypophysis, its connection with hypothalamus. The nature of the action of hormones of the anterior pituitary gland lobe. Hypo- and hypersecretion of adenohypophysis hormones.
94. Neurohypophysis, its connection with hypothalamus. Effects of hormones of the posterior lobe of the pituitary gland (oxytocin, ADH). The role of ADH in the regulation of fluid volume in the body. Non-sugar urination.
94. Thyroid and parathyroid glands, their functions.
95. Synthesis, storage and release of thyroid hormones. Transport of thyroid hormones in the blood.
96. Disorders of thyroid gland. Thyroid function tests.

97. Mechanisms of maintaining calcium and phosphate concentrations in the blood. The importance of vitamin D. Hypo and hyperfunction states.
98. Endocrine function of the pancreas. Mechanisms of action of its hormones on carbohydrate, fat and protein metabolism. Regulation of glucose content in the liver, muscle tissue, nerve cells. Diabetes mellitus. Hyperinsulinemia.
99. Adrenal cortex. Functions of hormones of the adrenal cortex.
100. Regulation Corticoid secretion. Hypo- and hyperfunction of the adrenal cortex.
101. Sympatho-adrenal system, its functional organization. Catecholamines as mediators and hormones. Participation in stress. Nervous regulation of the chromaffin adrenal tissue.
102. Sex glands. Functions of female sex hormones. Menstrual-ovarian cycle, its mechanism. Fertilization, pregnancy, childbirth, lactation. Endocrine regulation of these processes.
103. Functions of male sex hormones. Regulation of their formation. Pre- and Postnatal influence of sex hormones on the body.
104. Additional endocrine systems (epiphysis, thymus, kidneys, gastrointestinal tract, heart, placenta). Tissue prostaglandins and their functions.
105. General idea of analyzers. Structure and physiological significance. Coding of information in sensory systems. The concept of sensation.
106. Classification of receptors. Primary and secondary sensing receptor cells. Mechanism of receptor excitation. Receptor potential. Generator potential. Adaptations of receptors.
107. Somatosensory analyzer. Skin receptors. Receptive field of the sensitive neuron. Tactile and temperature sensitivity.
108. Pain, general idea of nociception and formation of pain sensations. Antinociceptive system, mediators. Types of pain. Pain management in clinic.
109. Musculo-articular analyzer. Proprioceptors, their importance in Maintenance of peripheral muscle tone.
110. The olfactory and gustatory analyzers. Localization and structure. Thresholds sensitivity. Adaptation. Functional relationship of olfactory and gustatory reception.
111. Visual analyzer. The optical system of the eye. Pupil and pupillary reflex.
112. Accommodation of the eye. Abnormal refraction of the eye (nearsightedness, farsightedness, astigmatism). Presbyopia (senile farsightedness).
113. Structures and functions of the retina. Photoreceptors. The blind spot.
114. Photochemical reactions in retinal receptors. Electrochemical phenomena in retina and optic nerve. Dark and light adaptation of the eye.
115. Methods of research of the visual analyzer (determination of visual acuity and visual field).
116. Visual pathway.
117. Color vision. Theories of color perception. Color blindness. Perception of Space.
118. Auditory analyzer. Structure and functions of the outer and inner ear.
119. Auditory pathway
120. Mechanisms of hearing.
121. The cortium organ, its structure and mechanism of excitation. Perception of sounds of different frequencies.
122. The vestibular analyzer. Labyrinth reflexes. Reception of the position of the body in space at rest and movement.
123. Analysis and synthesis in the cerebral cortex
124. The second signaling system. Interaction of the first and second signaling systems.
125. Neurophysiological mechanisms of speech. Broca's and Wernicke's zones. Perception of speech. The first and second signaling systems.
126. Speech disorders with damage to various areas of the brain.
127. Physiological mechanisms of perception and thinking. Types and Structure of Thinking.
128. Motivations as a factor in the organization of behavior. Physiological theories motivations.
129. Types of higher nervous activity (I.P. Pavlov), their characteristics.

130. The main properties of the nervous system, which are the basis for classification of the types of higher nervous activity. (I.P. Pavlov). The concept of temperament (Hippocrates).
131. Learning and memory. Types of memory: iconic, short-term, long-term, Their duration.
132. Characteristics of memory: memorization, retention, retrieval, playback.
133. Mechanisms of short-term and long-term memory. Role of Hippocampus, cerebral cortex, other CNS departments in memory organization.
134. Memory disorders.
135. Emotions, their functions and types. Theories of emotion. The role of emotions in the organization of behavior.
136. Stress, its types, stages and mechanisms. The influence of stress on Activity, cognitive and integrative processes.
137. Classical conditioned reflexes (I.P. Pavlov). Methods of developing conditioned reflexes.
138. Types of conditioned stimuli. Classification of conditioned and unconditioned reflexes. Biological significance of conditioned reflexes.
139. The mechanism of formation of conditioned reflexes at the neuronal and cellular level.
140. Inhibition of conditioned reflexes. Types of conditioned and unconditioned inhibition, their characteristics.
141. Electrical phenomena in the cerebral cortex. Characteristics of waves on the electroencephalogram (EEG), the mechanism of their occurrence.
142. Electrical Activity of cortical neurons in conditions of rest and activity organism (desynchronization).
143. Evoked potentials. Primary, secondary responses, their peculiarities. Clinical use of EEG.
144. Biological rhythms. Infra-ultra-circadian rhythms of the human body.
145. The nature of sleep. Fast and slow sleep, their peculiarities according to electrical activity of cerebral cortex, vegetative reaction of organism.
146. Modern concepts nerve structures controlling the development of sleep and awakening, influencing slow phase of sleep. Dreams.
147. Sleep-wake cycle disorder.