Khanty-Mansiysk Autonomous Okrug-Ugra
"Surgut State University""

Approved by
Deputy Rector for Academic Affairs
_____ EV. Konovalova

“13” June , 2024, Record No.5

Biochemistry

Syllabus

Department	**Morphology and physiology**
Curriculum	s310501- ЛечДелоИн-24-2.plx Specialty 31.05.01 General Medicine
Qualification	**General Practitioner**
Form of education	**Full-time**
Total (in credits)	**7**

Total academic hours	252	Control:
including:		Exam, 4th term
Classes	160	
Self-study	47	
Control hours	45	

Course outline in terms

Academic year (Term)	**3 (2.1)**		**4 (2.2)**		Total	
Weeks	17 2/6		17 2/6			
Types of classes	Cur	Syl	Cur	Syl	Cur	Syl
Lectures	16	16	16	16	32	32
Practical	64	64	64	64	128	128
Contact	80	80	80	80	160	160
Self-study	28	28	19	19	47	47
Control hours	-	-	45	45	45	45
Total	108	108	144	144	252	252

The Syllabus is compiled by:
PhD in Biology, Associate Professor, Maltsev V.P. _____

The Syllabus
Biochemistry

Developed in accordance with Federal State Educational Standard:

Federal State Educational Standard of higher education in the specialty 31.05.01 General medicine (Order of the Ministry of Education and Science of the Russian Federation on August 12, 2020 No. 988)

Based on the Curriculum:
31.05.01 GENERAL MEDICINE
Specialization: General Medicine
Approved by the Academic Council of Surgut State University, 13 June 2024, Record No. 5

The Syllabus was approved by the department
Morphology and physiology

Head of Department, Doctor of Medicine, Professor Stolyarov V.V.

1. COURSE OBJECTIVES	
1.1	The **aim** of the course is to form knowledge about the chemical nature of substances of living organisms, their transformations, the connection of these transformations with the activity of organs and tissues, the basic patterns of metabolic processes and the consequences of their violation; determination of health state and human adaptation at the molecular, cellular and organ levels of the whole body; the ability to analyze results data of biochemical studies and use the gained knowledge to explain the nature of measurable changes in human and to make the diagnosis of the disease.
1.2	**The objectives:** – the acquisition of knowledge about the chemical nature of substances that make up living organisms, their transformations, the connection of these transformations with the activity of organs and tissues, the regulation of metabolic processes and the consequences of their violation; – developing students' skills in using laboratory equipment and reagents in compliance with safety regulations, analyzing the data obtained from biochemical research results and using the knowledge gained to explain the nature of changes occurring in the human body and diagnosing the disease; – formation of skills of analytical work with information (educational, scientific, regulatory and reference books and other sources), with information technology, diagnostic research methods
2. COURSE OVERVIEW	
Course code (in curriculum)	B1.O.04.07
2.1	**Assumed background:**
	Human Anatomy Histology, Embryology, Cytology Biology Chemistry
2.2	**Post-requisite courses and practice:**
	Hygiene X-Ray Diagnostics Pathophysiology Clinical Pathophysiology Pharmacology
3. COMPETENCES UPON COMPLETION OF THE COURSE (MODULE)	
GPC-5.4 Demonstrates knowledge of the classification and structure of biochemical compounds, mechanisms of biochemical processes in the body, and understands their importance in maintaining homeostasis, metabolism, and pathogenesis of human disease;	
GPC-5.8 Demonstrates understanding of mechanisms of development of general pathological processes, knowledge of issues of pathogenesis of various human diseases and pathological conditions, ability to identify the leading links of pathogenesis in their relationship in a particular disease or pathological condition and on this basis the ability to justify effective pharmacotherapy;	
By the end of the course students must:	
3.1	**know:**
3.1.1	general patterns of the origin and development of life, human anthropogenesis and ontogenesis;
3.1.2	safety regulations in biochemical laboratories; the structure and chemical properties of the main classes of biologically important organic compounds;
3.1.3	structure and biochemical properties of the main classes of biologically important compounds: proteins, nucleic acids, carbohydrates, lipids, vitamins;
3.1.4	basics of enzymatic catalysis; basics of bioenergy;
3.1.5	role of cell membranes and their transport systems in the metabolism in the human body; main metabolic pathways; transformation of biologically important compounds: carbohydrates, lipids, amino acids and nucleotides;
3.1.6	main mechanisms of metabolic transformations; chemical and biological essence of the processes occurring at the molecular and cellular levels in the human body; mechanisms leading to changes in the composition of components of the body biological matrix;
3.1.7	main instruments and equipment used in the course of biochemical studies of biological material; biochemical methods of laboratory research in ambulatory and inpatient patients; characteristics used in the biochemical diagnosis of biological material; rules for obtaining, transporting and storing samples of biological material; pre-analytical preparation of biological material; accepted units for expressing the results of clinical and biochemical studies; physiological causes of changes in diagnostically significant biochemical parameters.
3.2	**be able to:**
3.2.1	classify chemical compounds, based on their structural formula; use biochemical laboratory equipment; substantiate the necessary set of biochemical parameters for assessing the status of the patient;
3.2.2	solve case problems;
3.2.3	find pathognomonic relations between changes in the content of individual components of human biological fluids and diseases of individual organs and systems, search the effectiveness of treatment, make the prognosis of the disease;

4. STRUCTURE AND CONTENTS OF THE COURSE (MODULE)						
Class Code	**Topics /Class type**	**Term / Academic year**	**Academic hours**	**Competences**	**Literature**	**Interactive**
	Section 1. Protein Chemistry					
1.1	Amino acid composition of proteins. Peptides /Practice/	3	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
1.2	Physical and chemical properties of proteins /Practice/	3	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
1.3	Final class of the section “Protein Chemistry”/Practice/	3	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
1.4	Protein chemistry/Self-study/	3	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4;	
	Section 2. Enzymes Coenzymes and prosthetic groups					
2.1	Structural Organization of Enzymes /Practice/	3	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
2.2	Mechanism of enzymes action /Practice/	3	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
2.3	Regulation of enzyme reactions /Practice/	3	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
2.4	Final class of the section "Enzymes" /Practice/	3	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
2.5	Basics of enzyme catalysis /Self-study/	3	6	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
	Section 3. Nucleic acids and matrix synthesis					
3.1	DNA structure and function. Polymerase chain reaction /Practice/	3	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
3.2	RNA structure and functions /Practice/	3	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
3.3	Protein synthesis and its regulation /Practice/	3	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
3.4	Final class of the section "Nucleic acids and matrix syntheses" /Practice/	3	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
3.5	Nucleic acids and matrix synthesis /Self-study/	3	6	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
	Section 4. Biological oxidation					

4.1	Introduction to biochemistry. The role of biochemistry in the preparation of a doctor. Introduction to metabolism. /Lecture/	3	2	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
4.2	General pathway of catabolism. Cycle of three carboxylic acids /Lecture/	3	2	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
4.3	Biochemical plan of the of biological membranes structure. Transmembrane substances transfer /Lecture/	3	2	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
4.4	Tissue breathing. METZ. Substrate and oxidative phosphorylation. Free oxidation and heat generation /Lecture/	3	2	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
4.5	Introduction to metabolism. General path of catabolism. Three carboxylic acid cycle and its regulation /Practice/	3	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
4.6	Mitochondrial electron transport chains. Ways of formation of ATP. Biomembranes /Practice/	3	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
4.7	Final class of the section "Biological oxidation /Practice/	3	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
4.8	Biological oxidation /Self-study/	3	6	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
	Section 5. Basics of Neuro-Endocrine Metabolism Regulation					
5.1	Basics of the neuro-endocrine regulation of metabolism. Mechanisms of the hormones activity /Practice/	3	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
5.2	Final class of the section "Fundamentals of neuro-endocrine regulation of metabolism" /Practice/	3	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
5.3	Basics of neuro-endocrine regulation of metabolism /Self-study/	3	6	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
5.4	Control /Control/	3	0	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
	Section 6. Carbohydrate exchange					
6.1	Anaerobic carbohydrate metabolism. Glycogen exchange /Lecture/	3	2	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
6.2	Aerobic carbohydrate conversion. Dichotomic dissociation of carbohydrates /Lecture/	3	2	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	

6.3	Gluconeogenesis, the pentose pathway of carbohydrate conversion. /Lecture/	3	2	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
6.4	Exchange and function of carbohydrates. Glycogen exchange /Practice/	4	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
6.5	Aerobic carbohydrate metabolism /Practice/	4	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
6.6	Final class of the section "Carbohydrate metabolism" /Practice/	4	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
6.7	Regulation of carbohydrate metabolism /Self-study/	4	6	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
	Section 7. Lipid metabolism					
7.1	Blood lipids. Lipoprotein exchange /Lecture/	3	2	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
7.2	Lipid digestion and absorption. Blood lipids / Practice /	4	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
7.3	Fatty acid oxidation /Lecture/	4	2	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
7.4	Ketogenesis. Cholesterol exchange /Lecture/	4	2	GPC-5.4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
7.5	Synthesis of fatty acids /Practice/	4	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
7.6	Fatty acid metabolism /Practice/	4	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
7.7	Tissue lipid metabolism /Practice/	4	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
7.8	Final class of the section "Lipid metabolism" /Practice/	4	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
7.9	Lipid metabolism /Self-study/	4	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
	Section 8. Amino acid metabolism					
8.1	General pathway for amino acid catabolism. Amino acids deamination /Lecture/	4	2	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	

8.2	Ammonia exchange. Mechanisms of toxicity / Lecture /	4	2	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
8.3	Sources and consumption of amino acids in the tissues /Practice/	4	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
8.4	Sources and ways of ammonia neutralization /Practice/	4	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
8.5	Specific amino acid metabolism Pathways /Practice/	4	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
8.6	Final class of the section "Amino acid metabolism" /Practice/	4	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
8.7	Amino acid metabolism /Self-study/	4	6	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
	Section 9. Biochemistry of special tissues					
9.1	Haemoglobin disorder. Exchange of bile pigments /Lecture/	4	2	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
9.2	Detoxifying liver function /Lecture/	4	2	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
9.3	Biochemistry of haemostasis. Vascular and platelet haemostasis /Lecture/	4	2	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
9.4	Biochemistry of special tissues /Lecture/	4	2	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
9.6	Liver biochemistry /Practice/	4	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
9.7	Blood biochemistry /Practice/	4	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
9.8	Water-electrolyte and salt exchange. Urine /Practice/	4	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
9.9	Biochemistry of the extracellular matrix /Practice/	4	4	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
9.10	Biochemistry of special tissues /Self-study/	4	3	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	

9.11	Control /Control/	4	0	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1; E1; E2; E3; E4; E5	
9.12	/Exam /	4	45	GPC-5-4, GPC-5.8	L1.1; L1.2; L2.1	

5. ASSESSMENT TOOLS

5.1. Tests and tasks

Presented by a single document

5.2. Topics for written papers

Presented by a single document

6. COURSE (MODULE) RESOURCES

6.1. Recommended Literature

6.1.1. Core

	Authors	Title	Publish, year	Quantity
L1.1	Glukhov A.I., Gubareva A.E.	Essential Biochemistry for Medical Students with Problem-Solving Exercises	Moscow: GEOTAR-Media, 2020, electronic resource	1
L1.2	Glukhov A.I., Babchenko E.V.	Biochemistry of the connective tissue. Biochemistry of mixed saliva	Moscow: GEOTAR-Media, 2019, electronic resource	1

6.1.2. Supplementary literature

	Authors	Title	Publish, year	Quantity
L2.1	by Glukhov A.I., Garin V.V	Biochemistry with exercises and tasks	Moscow: GEOTAR-Media, 2020, electronic resource	1

6.2. Internet resources

E1	http://biochemistry.ru/Biologicheskajahimija2011/#/1/
E2	biochemistry.terra-medica.ru
E3	edu.sernam.ru/book_b_chem1.php?id=4
E4	http://biokhimija.ru/lekcii-po-biohimii.html
E5	http://www.biochemistry.ru/biohimija_severina

6.3.1 Software

6.3.1.1	Operational system Microsoft, applied programs pack Microsoft Office
6.3.1.2	Internet access (Wi-Fi)

6.3.2 Information Referral systems

6.3.2.1	"Garant", "Consultant-plus"

7. MATERIAL AND TECHNICAL SUPPORT OF DISCIPLINE (MODULE)

7.1	Classrooms for lecture-type classes, seminar-type classes (practical classes), group and individual classes, ongoing monitoring and intermediate certification are equipped with: standard educational furniture, technical training tools that serve to present educational information
7.2	The lecture hall is equipped with a multimedia projector, a screen, a laptop, a stationary chalk board, standard educational furniture: desks, chairs
7.3	The classroom for practical classes is equipped with:
7.4	personal projector, laptop, computers, videos, tables included.
7.5	Tools and consumables in an amount that allows students to master the skills and abilities provided by professional activities.