MINISTRY OF SCIENCE, HIGHER EDUCATION AND INNOVATION OF THE KYRGYZ REPUBLIC
OSH STATE UNIVERSITY
INTERNATIONAL MEDICAL FACULTY

DEPARTMENT OF NATURAL SCIENCES AND MATHEMATICS

TRAINING PROGRAM (Syllabus)

Specialty (direction)	General Medicine (GM)	Course code	N.1.1.1
Language of instruction	English	Discipline	Bioorganic Chemistry
Academic year	2025-2026	Number of credits	4
Teacher	Imatali kyzy K. Zhumaeva A. Tangatarova S.	Semester	1
E-Mail	kimatalikyzy@oshsu.kg ajumaeva@oshsu.kg stangatarova@oshsu.kg	Schedule for the application "OshSU Student"	
Consultations (time/room)	IMF, 105	Location (building/room)	IMF, 105
Form of study (daytime/correspondence/evening/distance learning)	Daytime	Course type: (compulsory/elective)	Compulsory

Head of the Educational Program "General Medicine" M.M. Bugubaeva, Associate Professor

Osh, 2025

Course characteristics:

Objective of the course: Formation of systemic knowledge and understanding of the role of biologically significant organic compounds as structural and functional components necessary for the formation of normal physiological indicators, and in the development of pathological processes.

Prerequisites	General Chemistry	
Post-requisites	Biochemistry, Clinical Biochemistry, Physiology	
Co-requisites (if necessary)	Medical Biology	
Learning outcomes of the discipline		
By the end of the course the student:		
LO (learning outcome) Basics of the educational program	learning outcomes of the discipline	Competencies
LO - 1 - Able to use basic knowledge of humanitarian, natural science, economic disciplines in professional work	***Knows and understands*** - *the essence and mechanisms of chemical processes occurring in the human body, regularities of chemical behavior of the main biologically important classes of inorganic and bioinorganic compounds necessary for consideration of processes occurring in a living organism;* *-explain the nature of chemical processes or reactions during the development of the organism that lead to various pathologies;* *Is able to identify the chemical essence of problems and utilize, arising in the course of professional activity of a doctor.*	***General competences-1****- is able and ready to analyze socially significant problems and processes, to use the methods of natural, mathematical and humanitarian sciences in various types of professional and social activities.* ***Social and personal competencies-3-*** *able and ready for continuous professional development, self-discovery, self-development, self-actualization, self-discovery, self-development, self-actualization; manage their time, plan and organize their activities, build a strategy of personal and professional development and training.*

LO - 11 - Can apply basic knowledge in the field of research activity to solve professional problems.	*Possesses the skills of working with educational, scientific and reference literature, search for sources of information and make generalizing conclusions;* -Possesses*the skills of using theoretical knowledge of chemistry in solving situational problems, studying medical problems, conducting research and development, scientifically substantiate the observed phenomena.*	***Professional competencies-32*** *-Able and willing to plan and conduct scientific research.* ***Instrumental competences-2*** *- able and ready to use information, bibliographic resources and information and communication technologies taking into account the basic requirements of information security.*

Calendar and thematic plan of lectures classes

No.	Week	Topic Title	Number of hours	points			
			Lecture	Lecture participation	Test (MCQ)	notes	total
Module 1							
1	1	Introduction. Classification and nomenclature of organic compounds. Chemical Bonding in organic compounds	2	1	2	1	4
2	2	Spatial structure and stereoisomerism	2	1	2	1	4
3	3	Types of organic reactions. Radical substitution at a saturated carbon atom.	2	1	2	1	4
4	4	Electrophilic addition and electrophilic substitution reactions	2	1	2	1	4
		Nucleophilic addition and nucleophilic substitution reactions					
5	5	Poly- and heterofunctional compounds involved in metabolic processes	2	1	2	1	4
		Current control					
6	6	Biologically active heterocyclic compounds.	2	1	2	1	4
7	7	α-amino acids, peptides and proteins.	2	1	2	1	4
8	8	Carbohydrates. General characteristics of carbohydrates.	2	1	2	1	4
9	9	Nucleotides and nucleic acids.	2	1	2	1	4
10	10	Lipids. Low molecular weight bioregulators	2	1	2	1	4
		Current control					
		Total	**20**				

Calendar and thematic plan of laboratory (practical) classes

No.	Week	Topic Title	Number of hours	points			
			Seminar (practical, laboratory) lesson	Class partici pation	Test (MCQ) or tasks	activity	total
Module 1							
1	1	Introduction. Classification and nomenclature of organic compounds. Chemical Bonding in organic compounds	2	1	2	1	4
2	2	Acidity and basicity of organic compounds.	2	1	2	1	4
3	3	Spatial structure and stereoisomerism	2	1	2	1	4
4	4	Types of organic reactions. Radical substitution at a saturated carbon atom.	2	1	2	1	4
		Current control					
5	5	Electrophilic addition and electrophilic substitution reactions	2	1	2	1	4
6	6	Nucleophilic addition and nucleophilic substitution reactions	2	1	2	1	4
7	7	Poly- and heterofunctional compounds involved in metabolic processes	2	1	2	1	4
		Current control					
Module 2							
8	8	Biologically active heterocyclic compounds.	2	1	2	1	4
9	9	Alkaloids, antibiotics, vitamins.	2	1	2	1	4
10	10	α-amino acids, peptides and proteins.	2	1	2	1	4
11	11	Carbohydrates. General characteristics of carbohydrates.	2	1	2	1	4
		Current control					
12	12	Nucleotides and nucleic acids.	2	1	2	1	4
13	13	Lipids. Low molecular weight bioregulators	2	1	2	1	4
14	14	Analysis of organic	2	1	2	1	4

		compounds					
		Current control					
		Total	**28**				

Plan for organizing students' self work

№	Title	Task for students' self work	Hours	Evaluation tools	Point	Literature	Completi n date
1.	**Topic 1.** Classificatio n and nomenclatur e of organic compound	1. Show the classification scheme of organic compounds. 2. Show the types of isomerism in organic compounds and IUPAC nomenclature as an example	3	Survey Test, discuss ion	0,5	[1,2,3,4] Ele tb. [1]	Week 1 Wednes-day, Thursday, Friday
2.	***Topic 2.*** Acidity and basicity of organic reactions	1. Show examples of acids and bases of Bransted and Lowry. 2. Explain the principles of LCMS	3	Referat presentatio n, essay	0,6	[1,2,3,4] Elect. res.	Week 2 Wednes-day, Thursday, Friday
3	***Topic 3.*** Spatial structure and stereo233iso merism	1. Depict the structural optical, geometric and conformational isomers.	4	Control work, survey	0,6	[1,2,3,4]	Week 3 Wednes-day, Thursday, Friday
4	***Topic 4.*** Types of organic reactions. Radical substitution at a saturated carbon atom	1. Show the reactions of radical substitution at the saturated carbon atom. 2. Explain the mechanism of radical substitution reactions	4	Referat presentatio n, essay	0,6	[1,2,3,4] Ele tb. [1]	Week 4 Wednes-day, Thursday, Friday
5	***Topic 5.*** Electrophili c addition to unsaturated compounds. Electrophili c substitution	1. Explain the mechanism of electrophilic addition and substitution reactions 2. Show the structure of π and σ complexes and give the concepts of	4	Control work, discussi on	0,5	[1,2,3,4] Ele tb. [1]	Week 5 Wednes-day, Thursday, Friday

	in aromatic compounds.	orienting substituents. 3. Disclose the features of electrophilic addition to conjugated systems					
6	***Topic 6:*** Mechanism of nucleophilic substitution reaction.	1. Explain the mechanism of nucleophilic substitution reaction. 2. Identify biologically important nucleophilic substitution reactions.	4	Referat presentation, essay	0,6	[1,2,3,4]	Week 6 Wednesday, Thursday, Friday
7	***Topic 7.*** Nucleophilic addition in carbonyl compounds	1. Characterize aldehydes, ketones and carboxylic acids 2. Determine the reactivity of a carbonyl group.	4	Scheme, presentation, portfolio	0,6	[1,2,3,4]	Week 7 Wednesday, Thursday, Friday
8	***Topic 8*** Poly- and heterofunctional compounds involved in metabolic processes	1. Identify heterofunctional derivatives of the benzene series as drugs. 2. Present the properties of aminobenzoic sulfanilic acid and salicylic acid.	4	Control work	0,5	[1,2,3,4] Ele tb. [1]	Week 8 Wednesday, Thursday, Friday
9	***Topic 9.*** Biologically active heterocyclic -ly compounds.	1 .Show the classification and characterization of biologically active heterocyclic compounds. Define five-membered and six-membered heterocycles. Pyridine. Pyrimidine. Purine. Diazepine.	4	Referat, presentation, portfolio	0,6	[1,2,3,4] Elect. res.	Week 9 Wednesday, Thursday, Friday
10	***Topic 10.*** Alkaloids, antibiotics and	1.Give the concept of alkaloids and an idea of the structure and basic properties of alkaloids.	4	Scheme, presentation, portfolio	0,6	[1,2,3,4]	Week 10 Wednesday, Thursday, Friday

	vitamins.	2.Define antibiotics (penicillin, cephalosporin, tetracycline)					
11	***Topic 11*** α- amino acids, peptides and proteins	1. Explain the primary structure of peptides and proteins. 2. Introduce the biologically important reactions of α-amino acids and the deamination reaction.	4	Scheme, presentation	0,6	[1,2,3,4]	Week 11 Wednesday, Thursday, Friday
12	***Topic 12*** Carbohydrates	1. Give the concept of monosaccharide derivatives. 2. Define disaccharides maltose, cellobiose, lactose and sucrose. Starch. Heparin.	4	Referat, presentation	0,6	[1,2,3,4] Ele tb. [1]	Week 12 Wednesday, Thursday, Friday
13	***Topic 13*** Nucleotides and nucleic acids	1. Define nucleosides, coenzymes. 2. Explain the primary and secondary structure of DNA. RNA. Types of RNA.	4	Test, survey, conversation	0,6	[1,2,3,4] Elect. res.	Week 13 Wednesday, Thursday, Friday
14	***Topic 14*** Saponifiable and unsaponifiable lipids	1. Characterize simple and complex lipids. 2.Illustrate schematically the hydrolysis and addition reactions of lipids.	4	Control questions	0,5	[1,2,3,4] Elect. res.	Week 14 Wednesday, Thursday, Friday

The points for the course consist of (100 points):

Module 1 - 25 points	Module 2 – 25 points
SSW ..... 8 Lectures, current knowledge control.....4 Practical classes, current knowledge control...4 Intermediate knowledge assessment 9	SSW.....8 Lectures, current knowledge control.....4 Practical classes, current knowledge control...4 Intermediate knowledge assessment 9
Final exam – 50 points	

Educational resources

(use the full link and indicate where the texts/materials can be accessed)	
Electronic resources	https://ibooks.oshsu.kg/book/?lg=1&id_parent=375&id1=390&id4=#
Electronic textbooks	1. Synelnyk T.B., Kostiuk O.S., Ostapchenko L.I./ Text book. BIOORGANIC CHEMISTRY 2021 https://biology.univ.kiev.ua/images/stories/Kafedry/Biochimiya/Biblioteka/TEXTBOOK_Bioorganic_chemistry_2021.pdf
Laboratory Physical Resources	*Chemical instruments, reagents*
Special software	
Textbooks (library)	1. S.E.Zurabyan / Fundamentals of Bioorganic Chemistry/ Textbook for medical students/ 2004, Second edition 2. Bio-Organic Chemistry / by Harish K. Chopra and Anupama Parmar / 2012, First edition 3. S.A. Iqbal / Bio-Organic Chemistry / New Delhi, 2011, First edition 4. Introduction to Bioorganic Chemistry and Chemical Biology by David Van Vranken and Gregory, A. Weiss / 2012, First edition