Designation of the discipline	**Bioorganic chemistry**
Semester(s) in which the discipline is taught	*4*
Responsible teacher	Khudanov Ulugbek Oybutaevich candidate of technical sciences , *Associate professor*
Language of education	*Uzbek, Russian*
Connection to the curriculum	*Optional*
Form of education	Lecture, practical classes and CPC
Training hours (this including communication hours , independent education)	**Total hours - 120.** **Audience Training hours - 60.** Lecture training The hour is 30. Practical training The hour is 30. **Independent education Hour – 60.**
ECTS	*4*
Prerequisites / Subjects with connection	Organic chemistry , analytical chemistry , physics and colloid chemistry , physics , biology , computer science
Purpose of science / education results	**Science teaching The goal *is*** for students The current state of bioorganic chemistry and its role in industry and development prospects, the structural properties of carbohydrates, lipids, alcohols, lipids, amino acids, the most important classes of bioorganic compounds, teaching and practice of researching substances , physicochemical The aim is to develop understanding of the methods and skills to apply them in practice . Chemist The course aims to teach students the knowledge and concepts gained from the study of natural compounds under investigation using crystallization, distillation, chromatography, electrophoresis and other methods , the study of their physicochemical properties, and the determination of the structure of compounds, including their spatial structure, using mass spectrometry, UV, IR and other optical spectroscopy methods, X-ray structural analysis, and X-ray diffraction, chemical synthesis and modification of the compounds under study, chemical modeling of their processes, etc.
Course content (topics)	The main theoretical part (lectures) . Topic 1 . Introduction. The purpose, research methods, function and importance of the science of bioorganic chemistry Topic 2. Carbohydrates and their properties. Topic 3. Lipids and their properties Topic 4. Poly and heterofunctional compounds . Topic 5. Structure and properties of amino acids, peptides, proteins Topic 6 . Vitamins and Vitamin-like substances Topic 7. Sterols and steroids Topic 8. Alkaloids Topic 9. Antibiotics Topic 10. Toxins and poisonous compounds of plants and animals Topic 11. Chemical structure and importance of isoprenoids **II. Instructions and recommendations for organizing practical training .** - to students theoretical in character knowledge systematization , consolidation and to deepen help to give ;

- to students practical issues to solve teaching , calculations , graphics and other kind of assignments to perform skill and qualifications to occupy assistance ;
- book , service documents and diagrams with to work , reference and scientific from literature to use to teach ;
- science to study typical was actions repetitive to perform through in the lecture formed connections and associations reinforcement (monotonous) stereotypical repetitions knowledge to understand take does not come);
- independent knowledge to take ability to form , that is oneself learning , self-study develop and oneself control to do methods , methods and methods mastery ;
- development provide creative activity student's personality , his scientific thinking and speech ; students creative hardworking as to grow help to give ;
– students knowledge try – enough fast idea to inform tool .

Practical training Recommended topics for:

The following topics are recommended for practical training:

1. Methods for isolating natural compounds .
2. Alcohols properties study
3. Phenol properties study .
4. Properties of carbohydrates study
5. Properties of fatty acids study .
6. Study of protein reactions.
7. Properties of vitamins study .
8. Properties of sterols and steroids study .
9. Properties of alkaloids study .
10. Properties of antibiotics study .
11. Toxins and toxic compounds
12. Chemical properties of isoprenoids study .

Independent learning - the formation of knowledge, skills and competencies in a specific subject that are specified in the curriculum and must be mastered by the student , It is a form of education that is carried out outside the classroom based on the teacher's advice and recommendations, and their readiness to share knowledge.

Therefore, planning and organizing students' independent learning and creating all the necessary conditions for this, teaching students in class, as well as teaching them to read more, showing them ways to gain knowledge, and providing opportunities for independent learning are among the main tasks of a higher education institution.

Student independent work (SIW) is a systematic activity aimed at the student's mastery of a certain part of the knowledge, skills, and competencies specified in the curriculum of a particular subject, both in and out of the classroom, based on the advice and recommendations of the subject teacher.

II I. Independent learning and independent work.

I II. Recommended topics for independent study:

Stereochemical properties of the carbon atom.
Amino acids. Nomenclature, structure.
Peptides. The nature of the peptide bond.
Structure and function of biologically active peptides.

	Peptide toxins and antibiotics. Structure and nomenclature of monosaccharides. Chemical and enzymatic synthesis of oligosaccharides. Methods for studying the structure of oligosaccharides: chemical, physicochemical, enzymatic. Polysaccharides structure study function Methods for studying the structure of polysaccharides: chemical, physicochemical, enzymatic. Types of plant polysaccharides Biological functions of polysaccharides. Glycoproteins and proteoglycans. Lipids are simple (fats, fatty alcohols, and waxes) and complex (neutral, polar, and oxylipin-containing) Lipid diversity Pharmaceutical preparations based on prostaglandins. Triterpene saponins. Tetraterpenoids – xanthophylls and carotenoids.
	I V. Coursework topics and **requirements . Bioorganic** chemistry Coursework in the subject is not recommended in the curriculum .
Exam shape	Bioorganic chemistry students knowledge of the structure, composition and properties of the most important bioorganic compounds, their components, methodological aspects of synthesis and structural analysis; teaching the laws of molecular chemical reactions in relation to the structure of biologically important molecules for the purpose is taught . By science current control , interval control and final controls in transfer students theoretical and practical knowledge assessment important . **1.Current control** students lesson training equipment during shown activity , practical skills and software supplies use ability to evaluate aimed at will be . **In class in training executable Exercises** : For students lesson in training topics submission . **From the audience outside Activity** : Students mastered materials based on house tasks or small presentations preparation **2.Intermediate control** Applied Bioorganic Chemistry application and theoretical of knowledge that it has been mastered assessment for done is increased . **Midterm test** : Bioorganic chemistry important topics own inside received tests . **3. Final control** Final control of the course in the end done increased and students general knowledge and skills to evaluate focused . **Final Exam** : All studied topics own inside received exam . These are tests , questions , or short and wide answers in the form of is taken . **Final Tests** : Topics assessment for transferable tests , theoretical knowledge , software supplies application and problems solution skills from the test is held .
Education results and for exams to be placed requirements	To fully master theoretical and methodological concepts on the topic, correctly reflect the results of the analysis, be able to

	independently think about the processes being studied, and complete assignments in current and intermediate forms of assessment, as well as assignments for final assessment. to do . The student must have submitted current tests, intermediate tests, and independent learning assignments in the relevant subject within the specified time frame. A student who has not submitted current control, intermediate control, and independent learning assignments, as well as who has scored in the range of "0-29.9" for these assignments and control type, will not be included in the final control type. Also, a student who misses 25 percent or more of the classroom hours allocated to a subject without an excuse will be expelled from that subject, will not be allowed to take the final exam, and will be considered to have not acquired the appropriate credits in that subject. A student who has not passed the final exam or who has not passed the final exam and has scored in the range of "0-29.9" for this type of exam is considered an academic debtor.
Recommendation done literature	1. EOOripov, A.O.Nasrullaev Bioorganic Chemistry T.2012 2. Tyukavkina , Yu.I.Baukov . Bioorganic chemistry. 3rd quest. Moscow. 2004 3. T.K. Yunusov, S.A. Maulyanov. Methods of physical research of natural compounds. Study guide. UzMU , 2006. 4. Introduction to Bioorganic Chemistry and Chemical Biology, David Van Vranken , Gregory A. Weiss, 2012, 504 pages 5. Yu.A. Ovchinnikov. Bioorganic chemistry. M., 1987. 6. R. Cooper G. Nicola Natural Products Chemistry. 2015 by Taylor & Francis Group , LLC 7. Tyukavkina N.A. i dr. Bioorganic chemistry Moscow: Drofa, 2016. 8. Ovchinnikov Yu.A. Bioorganic chemistry. Moscow: Prosveshchenie, 2017. **9.**Joule DJ, Mills K. Chemistry of heterocyclic compounds. M.: Mir, 2004 10. Osipova O.V., Shustov A.V. Bioorganic chemistry: Synopsis lecture. content . mail . ru / arch /13081/1002506. htm 11. Egorov N.S. Osnovy uchenia ob antibiotikax. Moscow: Vysshaya shkola, 2016 . 12. Britton G. Biochemistry of natural pigments. Moscow: Mir, 2016. 13. Pentegova V.A., Dubovenko J.V., Raldugin V.A., Schmidt E.N. Terpenoidy xvoynyx rasteniy. Novosibirsk: Nauka, 2017. 14. G'Siddikov , I.Mehmonov , Sh.Sulaymonov Bioorganic chemistry . (laboratory their training transfer according to educational-methodical guide) Namangan - 2021