

MINISTRY OF EDUCATION OF THE REPUBLIC OF AZERBAIJAN
SUMGAI STATE UNIVERSITY

Working teaching program on the subject of Environmental chemistry and
basics of toxicology

S Y L L A B U S

Specialization: 050606–Environmental engineering

Faculty: Chemistry and biology

Department: Ecology

It was approved at the meeting of Scientific Council of Sumgayit State University

" ____ " _____ dated 2021 (protocol No. ____).

Chairman of the Scientific Council _____ prof. E. B. Huseynov

Working teaching program - syllabus was prepared by senior lecturer G.M. Seyidova and assistant A.Sh. Aliyeva.

It was discussed at the meeting of the department of Ecology on September 13, 2021 (protocol No. 01).

Head of the department: assoc.prof. R.R. Ahmadova

“ ____ ” _____ 2021

It was discussed and approved at the meeting of the Scientific Council of the faculty of Chemistry and biology on September 14, 2021 (protocol No. 01).

Chairman of the meeting: assoc.prof. M. M. Muradov

“ ____ ” _____ 2021

It was recommended to be approved by the Teaching Methodological Council of SSU (protocol No.

Chairman of TMC: assoc.prof. M.M. Mustafayev

“ ____ ” _____ 2021

Information about lecturers and department

Gulaya Seyidova Mirish gizi – senior lecturer

Azade Aliyeva Shukur gizi - assistant

The department of Ecology is located in room No. 1314 in the II educational building (43-district) of SSU.

Contact phone: 64-2-15-06 extension 1-40

Volume of the subject

Semestr	Quantity of Credit	Types of lessons				STIW Hour	STW Hour	General hours	Attestation form
		Auditorium lessons			Total hours				
		Lecturer	Practical lesson	Laboratory					
3	5	30	30	-	60	36	54	150	exam

Characterization of the subject

Basics of environmental chemistry and toxicology subject 050606-Environmental engineering is included in the approved Educational Program of the Ministry of Education and belongs to the department of specialized subjects (IF-B07, 5 credits).

The purpose of the subject

It is to learn information about the effect of photochemical, chemical, and biogenic exchange processes in the objects that make up the environment on the life activity of the transformations that occur as a result of anthropogenic effects, the effects of harmful production factors (chemical substances, radiation on the human body, the formation of mutagenic transformations in the body and ways to protect against them.

Tasks of the subject

The main tasks of the subject of Environmental chemistry and the basics of toxicology are to teach environmental engineering students the effect of harmful substances on the body, irritating and lethal doses, the need to protect natural ecological systems, the field of its application, and theoretical knowledge.

A student mastering the subject:

- manifestation of potentially toxic substances in the environment; ways of toxic substances entering the human body;
- to use the basics of toxicological normalization;
- to systematize and structure information about the studied object;
- distinguish priority pollutants in specific environmental conditions;
- assess the ecological situation for human health and the environment.

Preliminary subjects

The following subjects should be mastered in order to learn the basics of environmental chemistry and toxicology.

Subjects	Sections of the subject
1. General chemistry	Fundamental laws of chemistry; Oxidation reduction reactions; Chemistry of elements.
2. Analytical chemistry and instrumental analysis	Analysis of chemicals
3. Fundamentals of physics	Natural processes; Physical phenomena in the atmosphere.
4. Mathematics	Mathematical scheme of ecological modeling

Further subjects

The knowledge gained in the subject of the basics of environmental chemistry and toxicology is used in mastering the following subjects:

1. Integrated management of water resources
2. Radioecology
3. Ecology of the biosphere

Thematic plan of the subject

Num №	Themes	Volume of types of training, in hours				
		Lec.	Les.	Lab.	STIW	SIW
1	2	3	4	5	6	7
1	Basic concepts, goals and issues of the subject [4-6].	2	2	-	2	4
2	A natural event of radioactivity. Ecotoxicology [1,2,5].	2	2	-	2	4
3	Physico-chemical processes occurring in the atmosphere, its structure and composition. Photochemical processes in the stratosphere. [1,2].	2	2	-	2	4
4	Hydrosyl and hydroperoxide radicals in the troposphere and stratosphere. The ozone layer and its role in the atmosphere. Photochemical oxidation of methane. Distribution of organic compounds in the atmosphere [2,5,6].	2	2	-	4	2

5	Carbonic acids and alcohols. Oxidation of atmospheric SO ₂ and photochemical oxidation [1,5].	2	2	-	2	4
6	Natural fog. Displacement of aerosols. The cycle of gases released into the atmosphere. The main carcinogenic substances and the environmental problems caused by them [1,3,5].	2	2	-	2	2
7	Chemistry of the hydrosphere [5,6].	2	2	-	2	4
8	Chemical contamination of the lithosphere [3-6]	2	2	-	4	4
9	Toxic compounds and their division into systems. [1,2].	2	2	-	2	4
10	Excretion of toxic compounds through kidneys and lungs [2,3].	2	2	-	4	4
11	A concept of receptor theory [1,2].	2	2	-	2	4

1	2	3	4	5	6	7
12	General characteristics of harmful substances affecting the body. [1,3].	2	2	-	2	2
13	Basic indicators of harmful substances. Branching order of the chain	2	2	-	2	4
14	Special toxic nature of methane derivatives. Effect of inorganic substances [1].	2	2	-	2	4
15	Acute and chronic poisoning [1,2]	2	2	-	2	4
	Total	30	30	-	36	54

Topics of (seminar) classes

1. Some physical and chemical processes occurring in the atmosphere
2. Decomposition and respiration processes in the hydrosphere
3. Chemical contamination of the lithosphere
4. Ozone layer, acid rain, natural fog
5. Coupling reactions, catalytic oxidation
6. Removal of H₂S from the gases emitted into the atmosphere
7. Radiation and environmental impact
8. Formation and chemistry of nitrates
9. Basic conventional signs
10. Separation of toxic compounds from the body
11. Chemical toxicology
12. Special toxic nature of methane derivatives
13. Tetrogenic, mutagenic and blastomogenic effect of poisons, carbon monoxide and poisoning with it
14. Decontamination of chemical industry and chemical weapons waste
15. Toxicology of metals

Thematic plan of the student's independent work with the teacher

№	Thema	Purpose of the lesson	Report form	Recommended literature
1	2	3	4	5
1	Effects of external, chemical environmental variability on behavior	Improvement of theoretical knowledge	Written	[1-3]
2	Distribution of chemical elements in the environment	_____””_____	—””__	[1-2]
3	Natural occurrence of radioactivity	_____””_____	—””__	[1-5]
4	Problems arising from water pollution with surfactants (SAM).	_____””_____	—””__	[1-3]
5	Distribution of organic compounds in the atmosphere	_____””_____	—””__	[1-4]
6	Interaction of endogenous and exogenous forces of the earth	_____””_____	—””__	[1-2]
7	Chemical-ecological factors of soils and their sanitary-hygienic significance	_____””_____	—””__	[1-5]

1	2	3	4	5
8	The role of living organisms in the formation of the biosphere	_____””_____	—””__	[1-4]
9	Cleaning of waste gases released into the atmosphere from nitrogen oxides	_____””_____	—””__	[1-6]
10	The interaction of various types and energies of radiation with the environment	_____””_____	—””__	[1-3]
11	Problems arising from water pollution with surfactants (SAM).	_____””_____	—””__	[1-3,6]
12	Effects of alcohol on the body	”””	”””	[1-3]
13	Precautions against halogens.	_____””_____	_____””_____	[1-2]
14	Effect of aromatic compounds.	”””	”””	[1-3]
15	Toxicokinetic methods	”””	”””	[7-9]
16	Mutagenic and carcinogenic substances	_____””_____	—””__	[7-9]
17	Toxicometric methods	”””	_____””_____	[7-9]
18	Effects of toxic substances on enzymes	_____””_____	_____””_____	[7-8]
19	Manufacturing damages	_____””_____	_____””_____	[7-8]
20	Embrotropic effects of chemicals	_____””_____	_____””_____	[7-9]
21	Toxicology of pesticides	_____””_____	_____””_____	[7-9]

Topics of the student's independent (free) work assignments

1. Transformation properties of chemical compounds in natural systems.
2. Geochemistry of the planet.
3. Dissemination of chemical elements into the environment.
4. Physico-chemical processes in the atmosphere.
5. Physico-chemical processes in the troposphere.
6. Biochemical circulation of substances in the atmosphere (water, carbon, oxygen, phosphorus, sulfur and nitrogen).
7. Photochemical processes in the stratosphere.
8. Free hydroxyl and hydroxide radicals in the troposphere.
9. Ozone and its cycle.
10. Cycle of ammonia and nitrogen oxides in the atmosphere.
11. Hydrosphere chemistry.
12. Decomposition and respiration processes in the hydrosphere.
13. Radiation and its impact on the environment.
14. Radiation pollution in the atmosphere.
15. Acquisition of chlorine and bromine and their effect on humans.
16. Mutagenic and carcinogenic substances.
17. Preventive measures for halogen poisoning.
18. Toxicology of pesticides.
19. Effect of poisons on a living organism
20. Acute poisoning.
21. Chronic poisoning
22. The main manifestation of the effect of industrial poisons.

23. Elimination of industrial poisons from the body.
24. Metabolism of poisons.
25. Industrial poisons and high air temperature.
26. Industrial poisons and low air temperature
27. Radiation energy.
28. Radiation protection means.
29. Occupational poisoning in industrial cities and their prevention.

Methodological support of the subject

Authors	The name of the methodological aid	Publishing	Date of publishing	Sayı	
				In the library	In the department
1	2	3	4	5	6
1. V.M. Abbasov, R.A. Aliyeva e.t.c.	Ecological Chemistry	Baku	2003	1	1
2. R.R. Ahmedova və A.E. Hüseynova	Environmental chemistry	Baku	2011	10	20
3. Abdullayev Sh.N. Huseynov V.H.	Basics of industrial toxicology	“Təbib”	2010	1	1
4. Каплин В.Г.	Основы экотоксикологии	Москва	2006	1	1
5. Антонович Е.А., Седокур Л.К.	Качество продуктов питания в условиях химизации сельского хозяйства	Москва	1990	1	1
6. . Гиорд А.О.	Применение пищевых добавок	Гиорд	1997	1	1
7. Саприн А.Н.	Детоксикация ксенобиотиков в организме	Химиздат	1990	1	1
8. Фелленберг Г.	Загрязнение природной среды	Москва	1997	1	1
9. Шаов А.Х., Хараев А.М.	Основы токсикологии	Москва	2000	1	1

Exam questions

1. The effect of external, chemical environmental variability on behavior
2. The role of living organisms in the formation of the biosphere

3. The main components of the biosphere and the ecosystem
4. Geochemical history of living matter, carbon and oxygen
5. Distribution of chemical elements in the environment
6. The concept and criteria of the impact of chemical substances on the environment
7. Search for new sources of food. Chemical food sources
8. Natural resources and their analysis
9. Metal reserves
10. Natural event of radioactivity
11. Ecotoxicology
12. Information on some environmentally hazardous chemicals.
13. Lithosphere.
14. Hydrosphere
15. Basic understanding of toxicology.
16. Basic parameters of toxicology.
17. Clinical toxicology.
18. Classification of poison and poisoning.
19. Toxicokinetics.
20. Understanding of expanded factors.
21. Carcinogenic factors.
22. Industrial toxicology.
23. Conventional signs of industrial toxicology.
24. Industrial poisons, their division into classes.
25. The main types of industrial poisons based on their biological effect.
26. Removal of toxic substances from the body.
27. Separation of toxic substances in the lungs.
28. Excretion of toxic substances through the kidney.
29. Excretion of toxic substances through the gastrointestinal system
30. Basic concepts, purpose and issues of environmental chemistry and toxicology.
31. Elements of toxicometry and criteria of poison.
32. The main types of classification of toxic substances and poisoning. Manifestation of the effect of poison.
33. Classification of toxic substances.
34. Damage to the bone system. Changes in the nervous system.
35. Damage to respiratory organs.
36. Transformation and neutralization of toxic compounds.
37. Cumulative coefficient, complex effect.
38. Sources of toxic substances.
39. Gaseous inorganic compounds and acids. Heavy metals.
40. Concept of receptor. Interaction of toxic substances with enzymes.
41. Entry of toxins into the body.
42. Biosolidification, bioaccumulation, biomagnification of toxicants in the body.
43. Resistance of living organisms to radiation. Biological effects of ionizing radiation on the human body.
44. Environmental pollution with hydrocarbons.
45. Air pollution with microorganisms producers, bacterial preparations and their components.
46. Drug poisoning. Herbal drugs and synthetic drugs.

47. Poisoning with herbal drugs. Poisoning by synthetic drugs.
48. Environmental assessment of water and water basin pollution.
49. Hygienic norms of the amount of toxic chemicals in drinking water.
50. Acute and chronic poisoning

Teaching and learning methods

The teaching and learning environment is organized in such a way that students can achieve the learning outcomes intended for the subject of Environmental Chemistry and Fundamentals of Toxicology in the Education program.

Teaching and learning methods are continuously reviewed and improved, taking into account innovative educational practices. Regular improvement of teaching and learning methods is carried out in cooperation with the Quality Control and Evaluation department of the Teaching Methodological Center and is the main component of the quality assurance system of SSU.

Individual teaching methods are widely used in the training process. These methods encourage a student-centered approach and students' active role in the learning process.

The following teaching and learning methods are used in the training process:

- lectures, practical exercises and laboratory exercises;
- presentations, discussions and debates;
- free (independent) work
- problem-based teaching;
- group assessment;
- distance education

Evaluation

The assessment is organized in such a way that it is possible to effectively measure the students' achievement of the expected learning outcomes in the subject of Environmental Chemistry and Fundamentals of Toxicology. This allows to monitor the achieved achievement, to evaluate the extent to which the results of the Education program have been achieved, to evaluate the extent to which the teacher correctly applies education and learning methods, and to organize an exchange of ideas with students.

Assessment methods are continuously reviewed and improved, taking into account innovative educational practices. Regular improvement and updating of evaluation methods is carried out in cooperation with the Quality Control and Evaluation department of the Educational Methodological Center and is the main component of the quality assurance system of SSU.

Individual assessment methods are widely used in the teaching process. These methods encourage a student-centered approach and the active role of students in the learning process.

The following assessment methods are used in the teaching process:

- written assignments;
- inquiries;
- open discussions;
- assessment of students' skills based on observations in practical exercises and laboratory exercises;

- evaluation of free (independent) work;
- frontal inquiry;
- group and self-assessment;

Evaluation criterion of student's knowledge

The student's exam grade for the subject is determined from the table based on the sum of the points (max 100%) collected in the tasks given by the stages (max 50%) and according to the final attestation (exam) result (max 50%).

Score	Assessment	Symbol
91-100	excellent	A
81-90	good	B
71-80	sufficient	C
61-70	satisfactory	D
51-60	insufficient	E
0-50		F

Obligation of the student

To study the subject, the student must:

1. Not being late for classes;
2. Not to miss classes without an excuse, to submit a certificate in case of illness, and in other cases a written explanation;
3. Attend all classes;
4. Complete and deliver all tasks according to the calendar plan;
5. To work the missed classes overtime set by the teacher.

Faculty Chairman of TMC:

assos.prof. A.Y.Bakhshaliyev