



The syllabus for discipline «ECOTOXICOLOGY»

1. General information	
Name of the faculty	pharmaceutical faculty
Educational program	22 Health, 226 Pharmacy, industrial pharmacy, Second (master's) educational level, full-time course
Навчальний рік	2021-2021
Course title, code	Basics of chemical metrology, OK35,
Department (address, phone, e-mail)	Department of toxicological and analytical chemistry 79010, Lviv, Pekarska str., 69 +38 (032) 368437 kaf_toxchemistry@meduniv.lviv.ua
Head of department (e-mail)	Halkevych Irine, PhD, Associated professor, galkirin@meduniv.lviv.ua
Year of study	4 th year
Semester	VII semester
Type of discipline	Elective
Викладачі	1. Bidnychenko Yuriy, PhD, Associated professor; bidnyuri@i.ua 2. Davydovych Sofia, PhD, Assistant professor, ihlitska.sophia@gmail.com 3. Kramarenko Serhiy, PhD, Senior Lecturer, sergeikr@gmail.com
Erasmus yes/no	no
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Total credits ECTS	32.0 credits
Total number of hours	90 h (Lectures – 20 / Practical classes – 30 / ISW – 40)
Language	English
Інформація про консультації	Consultations at the department take place in accordance with the approved schedule of consultations
2. Course description (abstract)	
The developed curriculum defines: the amount of knowledge of the elective discipline "Ecotoxicology", which the student must master in accordance with the requirements of educational and qualification characteristics of the future specialist; algorithm of studying the educational	

material of the discipline taking into account the interdisciplinary of the bundles; necessary methodological support and methodology for assessing students' knowledge.

The work curriculum of the elective discipline "Ecotoxicology" establishes the ideology of the content of education and organization of the educational process, defines the educational and methodological foundations of the department. This Program is the basis for the development of all teaching materials for the educational process, including for students' independent work.

Environmental Toxicology (Ecotoxicology) is a section on toxicology that studies the effects of toxic substances on ecosystems and their cycling in the biosphere, especially in food chains.

Environmental Toxicology studies the sources of toxicant input into natural biosystems, the toxic effects of the effects of chemicals on living organisms, as well as the persistence and functioning of biosystems at the organismal level under conditions of their toxic contamination.

However, power the basic biological about objects of study ecotoxicology is human. From this point of view, ecotoxicology designed to solve one of the most important is a problems of human ecology – protection of health of people from damage by harmful substances found in the environment. Unlike traditional, modern ecotoxicology studies toxic effects not only on the level of the body in, but also largely on the population and would also biocoenosis levels. Another feature of ecotoxicology is studying the toxic action of environmental as an active component that influences the manifestation of toxicity. Thus, a systematic approach to solving the problems of protecting humans and biota in general from harmful substances is carried out.

Goals and objectives of ecotoxicology: the study of types of ecotoxicity, their mechanisms and consequences.

3. Goals and objectives of the course

1. The purpose of the «Ecotoxicology» course is preparation of students for the development of medical-biological and special disciplines, for which on the basis of modern scientific ideas to form in students the necessary knowledge, skills and abilities in the field of toxicological chemistry.

2. The main tasks of studying the discipline «Ecotoxicology» are:

- formation of students' knowledge and skills, practical skills in toxicology, which is a general theoretical discipline in the system of pharmacist training;
- preparation of students for mastering a special pharmaceutical discipline – toxicological chemistry, as well as obtaining basic toxicological knowledge necessary for understanding and mastering a number of medical-biological and chemical disciplines studied at the Faculty of Pharmacy.

3. Competencies and learning outcomes, the formation of which is facilitated by discipline (the relationship with the normative content of the training of higher education graduates, formulated in terms of results of study in the Standard of Higher Education).

According to the requirements of the Standard discipline «Ecotoxicology» contributes to the acquisition of students competencies:

integral:

- ability to solve typical and complex specialized problems and practical problems in professional pharmaceutical activity, applying the theoretical principles of the basics of chemical processes and methods of chemical and physical-chemical analysis (qualitative and quantitative) that involves conducting experimental research, introducing innovative methods of analysis, to reasonably justify the results of definitions and to unambiguously communicate their findings and knowledge to the professional and non-physical audience; general:
- ability to apply knowledge in practical situations
- knowledge and understanding of the subject area and understanding of the profession;
- ability to abstract thinking, analysis and synthesis, ability to learn and master modern knowledge;

- skills of using information and communication technologies;
 - the ability to evaluate and ensure the quality of performed work;
 - ability to conduct research at the appropriate level;
 - striving to preserve the environment;
- with special (specialty, subject) :**
- - ability to analyze data from educational and special literature in solving professional problems related to ecotoxicological research;
 - - ability to organize research to determine ecotoxicological safety parameters of chemicals;
 - - ability to analyze and interpret the results obtained in the study;
 - - ability to predict possible mechanisms of toxic action;
 - - ability to use specialized software in ecotoxicological research;
 - - ability to document ecotoxicological research (working journal)
- Detailing competencies according to the NRC descriptors in the form of the Competence Matrix.

4. Course prerequisites

«Ecotoxicology» as a discipline that is based on the knowledge, skills and knowledge acquired by students in the study of previous disciplines:

- mathematics, physics, biology, inorganic, organic and biological chemistry;
- establishes the basis for the study of pharmaceutical and toxicological chemistry and involves the formation of skills for the use of the knowledge acquired for the study of special disciplines and professional activities.

5. Programm learning outcomes

List of learning outcomes

Code of learning outcomes	Content of learning outcomes	Link to the Competence Matrix code
<i>Knowledge – Kn., Skill – Sk., Communication – C., Autonomy and responsibility – AR.</i>		
General competencies		
Kn-1	Have specialized conceptual knowledge acquired in the learning process.	<i>IIP-2. Ability to apply knowledge in practical situations</i>
Sk-1	Be able to solve complex problems and problems that arise in professional activity.	
C-1	Clear and unambiguous communication of their own conclusions, knowledge and explanations, which substantiate them to specialists and non-specialists.	
AR-1	Responsible for acceptance decisions in difficult conditions	
Kn-2	Have deep knowledge of structure professional activity.	<i>IIP-6. Knowledge and understanding of the subject area and understanding of the profession</i>
Sk-2	Be able engage in professional activities that require updating and integration of knowledge.	
C-2	Ability to effectively shape communication strategy in professional activities.	
AR-2	Be responsible for professional development, the ability to further vocational training with a high level of autonomy.	
Kn-3	Know the methods of analysis, synthesis and further modern learning.	<i>IIP-4. Ability to abstract thinking, analyzing and synthesizing, being</i>
Sk-3	Be able to analyze information, make informed decisions, and be able to acquire modern knowledge.	

C-3	Establish appropriate links to achieve goals.	<i>able to learn and be modern in learning.</i>	
AR-3	Be responsible for the timely acquisition of modern knowledge.		
Kn-4	Have deep knowledge in the field of information and communication technologies used in professional activity	<i>IIP-9. Use of information and communication technologies</i>	
Sk-4	Be able to use information and communication technologies in the professional field that requires updating and integration of knowledge		
C-4	To use information and communication technologies in professional activity		
AR-4	Be responsible for the development of professional knowledge and skills		
Kn-5	Know the methods of evaluating performance indicators	<i>IIP-11. Ability to evaluate and ensure the quality of work performed</i>	
Sk-5	Be able to provide quality work		
C-5	Establish links to ensure the quality of work		
AR-5	Be responsible for quality work		
Kn-6	Know the components of the health care system, plan and evaluate research		<i>IIP-12. Ability to conduct research at an appropriate level;</i>
Sk-6	Search for scientific sources of information; to choose the methods of scientific research, to use the methods of mathematical analysis and modeling, theoretical and experimental research in pharmacy		
C-6	Use information from scientific sources		
AR-6	Be responsible for the development and implementation of planned projects		
Kn-7	Know the problems of environmental conservation and how to conserve it	<i>IIP-3. The desire to preserve the environment</i>	
Sk-7	Be able to formulate requirements for yourself and others for environmental protection		
C-7	Make proposals to the relevant authorities and agencies on conservation and environmental protection measures		
AR-7	Be responsible for the implementation of environmental measures within its competence		
Special (specialized, subject) competences			
Kn-8	Know the modern requirements for the organization and control of environmental safety of medicines.	<i>IIP-__. Ability to organize research to determine different types of toxicity and environmental safety of test substances..</i>	
Sk-8	Be able to choose methods for studying the ecotoxicity of drugs.		
C-8	To substantiate the chosen methods of research of medicines.		
AR-8	To be responsible for the organization, maintenance and control of ecological safety of medicines.		
Kn-9	Know the ecotoxicological properties of xenobiotics.	<i>IIP-__. Ability to predict possible mechanisms of ecotoxic action.</i>	
Sk-9	Be able to apply toxicological models to calculate ecotoxicological parameters.		
C-9	It is reasonable to evaluate the results of toxicological and		

	ecotoxicological studies.	
AR-9	Be responsible for deciding on the evaluation of the results of research on the environmental safety of medicines.	
Kn-10	Know the mathematical models for calculating toxicological and ecotoxicological parameters.	<i>IIP-14. Ability to use specialized software in toxicological research.</i>
Sk-10	Be able to use special software to calculate the environmental safety of drugs.	
C-10	It is reasonable to evaluate the results of toxicological and ecotoxicological calculations.	
AR-10	Be responsible for deciding on the evaluation of the environmental safety of medicines.	
Kn-11	Know the standard procedures of statistical analysis.	<i>IIP-32. Ability to analyze and interpret the results obtained in the study.</i>
Sk-11	Be able to justify the sample size, apply methods of statistical analysis, and provide the results of statistical data processing.	
C-11	It is reasonable to evaluate the obtained results.	
AR-11	Be responsible for conducting the analysis and obtaining reliable and reproducible results.	

6. The course format

The format of the course	Full-time course		
Type of classes	The total number of hours	The number of hours in 3 semester	The number of hours in 4 semester
Lectures	10	6	4
Practical classes	10	6	4
Self-study	40	20	20

7. Topics and content of the course

Type of classes	Theme	Code of learning outcomes
L-1	Prerequisites for the emergence of environmental toxicology. History of formation of ecotoxicology as a science. Combining the concepts of "ecology" and "toxicology". Connection with other sciences. Characteristics of the subject, tasks and objects of ecological toxicology. Special types of toxicology. Scientific and practical problems of modern ecotoxicology.	Kn-1 – Kn-15; Sk-1 – Sk-15
L-2	Formation of environmental pollution by toxic substances under the influence of economic activity. Practical classification of toxic substances. Industrial toxic substances. Pesticides. Influence of pesticides on living organisms and soil system. Classification of toxic substances by selective exposure.	C-1 – C-15; AR-1 – AR-11
L-3	Experimental determination of toxicometry parameters. Hygienic regulation and standardization of xenobiotics. Evaluation of the degree of ecotoxicity. Environmental Impact Assessment (EIA). Scientific, legislative and regulatory framework of the EIA. Basic principles of hygienic rationing of chemicals.	

L-4	The concept of the mechanism of toxic action. Toxicity receptors. Receptors of primary action. Occupation theory of A. Clark. The main provisions of the modern theory of toxicity receptors.		
L-5	The mechanism of action of xenobiotics in the body. Regularities of formation of toxicity of poisons.		
L-6	Substances used in crop production. Chemical plant protection products: pesticides, growth regulators, mineral fertilizers.		
L-7	Contamination of food by microorganisms and their metabolites: bacterial toxicosis and toxicoinfections.		
L-8	Heavy metals. Dioxins and their derivatives. Hydrocarbon pollution. Polycyclic aromatic hydrocarbons. Biphenyls. Polycyclic aromatic and chlorine-containing hydrocarbons. Contamination with substances and compounds used in the home: phthalates, formaldehyde, chlorine, surfactants.		
L-9	Mutagenic and carcinogenic effects of chemicals. Classification of carcinogens. Polycyclic aromatic hydrocarbons. Nitrosoamines. Aromatic amine. Heterocyclic amines. Nitroso compounds.		
L-10	Environmental monitoring. Classification of environmental monitoring. Forms of migration of pollutants between natural environments. Soil and ecological monitoring. Criteria for assessing the ecological purity of the object. Regulations.		
Type of classes	Theme	Content	Code of learning outcomes
P-1	<i>Ecotoxicology as a science. The current state of the environment.</i>	The ecological crisis and its connection with the state of natural ecosystems. Environmental pollution. The main types of pollutants and their sources. Atmospheric pollution. Types of water pollution. Priority scientific directions. Practical research results. The main classes of toxic substances. Xenobiotics, supercotoxicants, "dirty dozen". The concept of persistence. Three main groups of pollution: point (local), chronic (regional), global.	
P-2	<i>Toxic substances in different environments. Principles of classification of toxic substances.</i>	Principles of assessing the toxicity of substances in ecosystems. Levels of biological influence and system of toxicological characteristics. The concept of the threshold of harmful substances. Stock ratio. Accumulation of harmful substances. Cumulation coefficient. Combined action of poisons. Adaptation and compensation during exposure to harmful substances. Addiction. Manifestations of poisons Sensitization. Additivity, synergy and antagonism during the joint influence of	

		harmful environmental factors.	
P-3	<i>Characteristics of pollutants and toxicity assessment parameters.</i>	Basic principles of hygienic rationing of chemicals. Ecological and hygienic rationing of the state of ecosystems. Ecological certification of food products. Parameters of ecosystems subject to registration at ecological rationing. The sequence of environmental rationing. The main criteria for determining the allowable environmental load. Methods for determining load limits.	
P-4	<i>Ecotoxicokinetics.</i>	Release of ecopollutants into the environment. Persistence of xenobiotics in the environment. Transformation of toxic substances in the environment. The concept of "ecotoxicokinetics". Acute and chronic ecotoxicity. Xenobiotic profile of the environment. Migration and stability of chemicals in the environment. Factors affecting bioaccumulation. Ecological magnification. Biomagnification.	
P-5	<i>Ecotoxicodynamics.</i>	The concept of "ecotoxicodynamics". Direct and indirect effect of the xenobiotic profile of the environment on the biotic or abiotic components of the habitat of the population. Consequences of indirect effects of toxicants on the environment. Bioaccumulation. Abiotic transformation of pollutants in the atmosphere, water and soil. Biotransformation of ecotoxicants in the body. Ecotoxicological effects for populations and ecosystems.	
P-6	<i>The mechanism of action of xenobiotics in the body.</i>	Characteristics of the poison's binding to the receptor (ionic, covalent, hydrogen, van der Waals). The effect of toxicants on the structural elements of cells.	
P-7	<i>Regularities of formation of toxicity of poisons.</i>	Relationship of toxicity with the structure and physicochemical properties of poisons. Formation of toxicity of a substance depending on the molecular weight, size and spatial structure of toxicant molecules. Basic regularities of isomerism influence on substance toxicity. Factors affecting the toxicity of substances.	
P-8	<i>The main toxicants in agricultural products.</i>	Contamination with substances and compounds used in animal husbandry: antibacterial agents, hormonal drugs, nitrogen-containing feed additives. Influence of toxic substances on ontogenesis, immune status of an	

		organism, etc.	
P-9	<i>Food contamination.</i>	Mycotoxins and mycotoxicosis. Sanitary safety criteria for food raw materials and food products. Sanitary and hygienic assessment of drinking water.	
P-10	<i>Anthropogenic pollution of the natural environment.</i>	Air pollution by microorganisms-producers, bacterial preparations and their components. Pharmaceutical pollution. Pharmaceutical ecology. The problem of accumulation and processing of garbage. The main pollutants formed from solid waste.	
P-11	<i>Modern ideas about chemical carcinogenesis.</i>	Aflatoxin B1. Arsenic. TCDD. Tobacco pyrolysis products. Benzpyrene. Asbestos. Sources and routes of radionuclides in the body. External and internal irradiation. Biological effect of ionizing radiation on the human body. Units and doses of human exposure. Technological ways to reduce the content of radionuclides in food products.	
P-12	<i>Consequences of pollution of aquatic ecosystems.</i>	The problem of "clean water". Features of the aquatic environment as a habitat. Water quality rationing. Water quality and types of water use. The main indicators of water quality. Classification of waters by integrated quality indicators. Biological indication of reservoirs. The concept of saprobity. Water saprobity system. Fields - meso- and oligosaprobic zones. The concept of toxicity. Classification of polluted waters. Natural and anthropogenic eutrophication of reservoirs. Cultural eutrophication. Influence of metal and acid pollution on components of aquatic ecosystems. Thermal pollution. Biological self-cleaning of reservoirs. Mineralization work of aquatic organisms. Accumulation of harmful substances by aquatic organisms. Transit of aquatic organisms of pollution from water to soil.	
P-13	<i>Population ecological toxicology.</i>	Ecological diagnostics, bioindication and ecological monitoring. The main criteria of ecological and hygienic rationing. Sources of pollutants in the environment. Toxicological characteristics of pollutants. Xenobiotic profile of the environment. Estimation methods, limit values. Environmental	

		standards. Regulations.	
P-14	<i>Ecotoxicants and man.</i>	The effect of pollution on the human body. The state of the environment and the incidence rate. Resistance of the organism. Isolated, combined, complex or combined effect of factors on a person. Chemical pollution of the environment and human health. Danger of exposure to polluted atmosphere: mass action, a variety of pollutants, direct access to the internal environment of the body, the difficulty of protection against antibiotics.	
P-15	<i>Protection of the person against dangerous substances in household and industrial conditions.</i>	Classification of pollutants by human exposure. Sensitivity of the organism at different stages of ontogenesis. Rules of conduct in emergency situations at work. First aid for lesions of various substances. The effect of antidotes. Environmental disasters.	
ISW-1	The ecological crisis and its connection with the state of natural ecosystems. Environmental pollution. The main types of pollutants and their sources. Atmospheric pollution. Types of water pollution. Priority scientific directions. Practical research results. The main classes of toxic substances. Xenobiotics, supercotoxicants, "dirty dozen". The concept of persistence. Three main groups of pollution: point (local), chronic (regional), global.		
ISW-2	Principles of assessing the toxicity of substances in ecosystems. Levels of biological influence and system of toxicological characteristics. The concept of the threshold of harmful substances. Stock ratio. Accumulation of harmful substances. Cumulation coefficient. Combined action of poisons. Adaptation and compensation during exposure to harmful substances. Addiction. Manifestations of poisons Sensitization. Additivity, synergy and antagonism during the joint influence of harmful environmental factors.		
ISW-3	Basic principles of hygienic rationing of chemicals. Ecological and hygienic rationing of the state of ecosystems. Ecological certification of food products. Parameters of ecosystems subject to registration at ecological rationing. The sequence of environmental rationing. The main criteria for determining the allowable environmental load. Methods for determining load limits.		
ISW-4	Xenobiotic profile of the environment. Migration and stability of chemicals in the environment. Factors affecting bioaccumulation. Ecological magnification. Biomagnification.		
ISW-5	Bioaccumulation. Abiotic transformation of pollutants in the atmosphere, water and soil. Biotransformation of ecotoxicants in the body. Ecotoxicological effects for populations and ecosystems.		

ISW-6	Relationship of toxicity with the structure and physicochemical properties of poisons. Formation of toxicity of a substance depending on the molecular weight, size and spatial structure of toxicant molecules. Basic regularities of isomerism influence on substance toxicity. Factors affecting the toxicity of substances.	
ISW-7	Contamination with substances and compounds used in animal husbandry: antibacterial agents, hormonal drugs, nitrogen-containing feed additives. Influence of toxic substances on ontogenesis, immune status of an organism, etc.	
ISW-8	Mycotoxins and mycotoxicosis. Sanitary safety criteria for food raw materials and food products. Sanitary and hygienic assessment of drinking water.	
ISW-9	Pharmaceutical pollution. Pharmaceutical ecology. The problem of accumulation and processing of garbage. The main pollutants formed from solid waste.	
ISW-10	Sources and routes of radionuclides in the body. External and internal irradiation. Biological effect of ionizing radiation on the human body. Units and doses of human exposure. Technological ways to reduce the content of radionuclides in food products.	
ISW-11	Classification of polluted waters. Natural and anthropogenic eutrophication of reservoirs. Cultural eutrophication. Influence of metal and acid pollution on components of aquatic ecosystems. Thermal pollution. Biological self-cleaning of reservoirs. Mineralization work of aquatic organisms. Accumulation of harmful substances by aquatic organisms. Transit of aquatic organisms of pollution from water to soil.	
ISW-12	Xenobiotic profile of the environment. Estimation methods, limit values. Environmental standards. Regulations. Forms of migration of pollutants between natural environments. Soil and ecological monitoring. Criteria for assessing the ecological purity of the object. Regulations.	
ISW-13	Environmental monitoring. Classification of environmental monitoring. Biomonitoring.	

Learning methods

Explanatory-illustrative, problematic presentation, partially-exploratory.

Studying Basics of chemical metrology students use textbooks, lecture notes, methodological guidelines, chemical computer software, molecular models, laboratory devices and glassware necessary for performing experiments.

Methods for organization and accomplishment of studies are:

- a) lectures
- b) practical classes
- c) students' independent study.

The topics of the lecture course cover the problematic issues of the appropriate sections of toxicological and forensic chemistry.

Practical classes are organized as laboratory classes. These classes include: laboratory studies on detection of specific classes of toxic compounds according to their functional groups, performing specific reactions. Students are recommended to write short-term protocols of laboratory studies, indicating the purpose of the study and the conclusions.

The structure of practical classes includes:

- Discussion and explanation of the most complicated issues of the topic;
- Written test;
- Practical (laboratory) work.
- Filling in a practical lesson protocol.
- Summary of the lesson.

The student's self-study material, which is provided in the subject of the practical lesson at the same time as the classroom work, is evaluated during the ongoing control of the topic in the relevant practical lesson.

Assessment of topics that are presented for self-study and not included in the topics of classroom training, are controlled during the final (credit) classes and exam.

Methodological support. The list and content of educational and methodological support for the study of the discipline «Ecotoxicology» includes:

- synopsis or extended lesson plan;
- thematic plans of lectures, practical classes, independent work of students;
- tasks for laboratory work and independent work of students;
- MCQ, problems for current and final control of students' knowledge and skills, complex control work, post-certification monitoring of acquired knowledge and skills in the discipline.

8. Verification of learning outcomes

Current control

Types of control: current (routine) and final. **Form of final control in accordance with the curriculum:** a credit (7 semester).

Control of knowledge and level of students' mastering theoretical material, independent work and the level of acquired skills and practical skills is carried out in practical classes by oral questioning of students; by means of test, graphic and written control; solving situational problems; by evaluating the practical experimental work performed, by assessing the student's ability to correctly interpret the research results obtained, and by evaluating the laboratory protocols drawn up.

At each practical session, the student answers standard questions from the material of the current topic of the lesson, the questions of the lecture course and independent work that relate to the

current lesson. The student demonstrates knowledge and skills of practical skills in accordance with the topic of the practical lesson.

It is recommended to apply objective (standardized) kind of control to check theoretical and practical knowledge of students.

The standardized control of the theoretical part includes 13 tasks. Ten of them are the first level test questions. Another three are referred to the tasks of the second level and required a written response (reaction schemes, structure formulas etc.) on the topic of the practical lesson, knowledge of which is necessary for understanding the current topic, questions of the lecture course and independent work related to the current lesson, demonstrates knowledge and skills of practical skills in accordance with the topic of the practical lesson.

Criteria of assessment of current educational activity:

"Excellent" mark receives a student who correctly, clearly, logically and completely answered the standardized questions of the current topic, including the questions of the lecture course and independent work, gave at least 90% of correct answers to standardized tests, responded to written tasks without any mistake, performed practical work and filled in the protocol.

"Good" mark gets a student who answered the standardized questions of the current topic, lecture course and independent work, gave at least 70% of correct answers to standardized tests, responded to written tasks with some insignificant mistakes, performed practical work and filled in the protocol.

"Satisfactory" mark receives a student who gave with additional questions incomplete answer, could not independently build a clear, logical answer; gave at least 50% of correct answers to standardized tests, responded to written tasks with a lot of mistakes, made mistakes while demonstrating practical skills but performed practical work and made the protocol.

"Unsatisfactory" mark receives a student who cannot answer on question on the current topic with additional questions, cannot construct a logical answer, did not understand the content of the material; gave less than 50% of correct answers to standardized tests, responded to written tasks with gross mistakes or did not give answer, didn't perform practical work and didn't make the protocol.

The total score for the current achievement is the arithmetic mean (CA) of the sum of the scores for the test control and the answers to the questions.

Only those students who completed all types of works provided by syllabus and during study scored points not less than the minimum (3.0), and don't have any undone lectures and practical classes are allowed to put the exam. The standardized form of the exam includes control of theoretical and practical knowledge.

Code of learning outcomes	Type of classes	Verification of learning outcomes	Enrollment criteria
Kn-1 – Kn-15; Sk-1 – Sk-15; C-1 – C-15; AR-1 – AR-15.	P-1–P-35 ISW-1–ISW-33	Current control: <ul style="list-style-type: none"> oral control over the topic of the lesson, standardized questions, knowledge of which is necessary to understand the current topic, questions of the lecture course that relate 	Assessment according to established criteria (see above) with 4-point (national) scale. To enroll in the discipline, it is necessary to confirm the achievement of

		to the current lesson; <ul style="list-style-type: none"> • written test control, • solving situational problems, • conducting laboratory tests, • interpretation and evaluation of laboratory test results, • report on the performed laboratory work. 	each learning outcome.
Kn-1 – Kn-15; Sk-1 – Sk-15; C-1 – C-15; AR-1 – AR-15.	ISW-1–ISW-33	<ul style="list-style-type: none"> • Oral control in the form of a survey in accordance with the subject of independent work. • Test control on the subject of independent work. 	Enrolled / not enrolled

The Final control

General evaluation system	<p>The final control is carried out upon completion of the study of the discipline Toxicological and Forensic Chemistry in the form of a credit (7 semester). Final control is allowed for students who have completed all types of work required by the curriculum, have completed all training sessions, and have earned points above the minimum level when studying the module. Participation in the work during the semester - 100% on a 200-point scale</p>	
Grades	4-point (national) scale, a multi-scale (200-point) scale, ECTS success scale	
Conditions of admission to the final control	Students who have completed all types of work required by the curriculum, have completed all training sessions, and have earned points above the 120 points when studying the course.	
Form of final control	The form of final control of the success of studies in the study of «Ecotoxicology» in the 4th semester is a credit .	Evaluation criteria
A credit	Each class assesses students' knowledge on a 4-point (national) scale. This takes into account all types of work provided by the discipline program. The assessment of basics of chemical metrology in the 4th semester is based on the results of the current educational activity and is expressed on a two-point scale “ enrolled ” or “ not enrolled ”. The student receives a grade on each topic to further convert the grades into scores on a multi-scale (200-point) scale.	<i>The maximum number of points - 200.</i> <i>The minimum number of points - 120</i>

Credit Regulations

The form of final control is standardized and includes control of theoretical and practical training.

"Excellent" – A student correctly, clearly, logically and fully responds to standardized issues of the current topic, including issues of independent work. Closely connects the theory with practice and correctly demonstrates the fulfillment (knowledge) of practical skills. Freely solves situational problems of increased complexity, is able to generalize the material.

"Good" – A student correctly and in essence answers standardized questions of the current topic, independent work. Demonstrates performance (knowledge) of practical skills. Correctly uses theoretical knowledge in solving practical problems. Is able to solve light and medium complexity situational tasks. Have the necessary practical skills and methods of their implementation in an amount that exceeds the required minimum.

"Satisfactory" – A student is incomplete, with additional questions, responsible for standardized issues of the current topic, lecture course and independent work. Cannot independently build a clear, logical answer. When answering and demonstrating practical skills, the student makes mistakes. Student solves only the easiest tasks, has only a minimum of research methods.

"Unsatisfactory" – A student does not know the material of the current topic, cannot construct a logical answer, does not answer additional questions, does not understand the content of the material. During the response and demonstration of practical skills makes significant, gross mistakes.

The maximum number of points that a student can get for current educational activity during study is 200 points.

The minimum number of points that a student must get to pass the test on the discipline is 120 points.

Calculating the number of points made on the basis of the student's scores on the traditional 4-point scale during the study of the discipline, by calculating the arithmetic mean (CA), rounded to two decimal places. The received value is converted into points by multi-point rate as follows:



The average score for the current activity is converted into a multi-scale scale using the table below:

Recalculation of the average score on "Ecotoxicology" for the current activity into a multi-scale scale:

4 point scale	5	4.97	4.95	4.92	4.9	4.87	4.85	4.82	4.8	4.77	4.75	4.72	4.7
200 point scale	200	199	198	197	196	195	194	193	192	191	190	189	188
4 point scale	4.67	4.65	4.62	4.6	4.57	4.52	4.47	4.45	4.42	4.4	4.37	4.35	4.32
200 point scale	187	186	185	184	183	181	180	178	177	176	175	174	173
4 point scale	4.3	4.27	4.24	4.22	4.19	4.17	4.14	4.12	4.09	4.07	4.04	4.02	3.99
200 point scale	172	171	170	169	168	167	166	165	164	163	162	161	160
4 point scale	3.97	3.94	3.92	3.89	3.87	3.84	3.82	3.79	3.77	3.74	3.72	3.7	3.67
200 point scale	159	158	157	156	155	154	153	152	151	150	149	148	147
4 point scale	3.65	3.62	3.57	3.55	3.52	3.5	3.47	3.45	3.42	3.4	3.37	3.35	3.32
200 point scale	146	145	143	142	141	140	139	138	137	136	135	134	133
4 point scale	3.3	3.27	3.25	3.22	3.2	3.17	3.15	3.12	3.1	3.07	3.02	3	L
200 point scale	132	131	130	129	128	127	126	125	124	123	121	120	Not

The maximum number of points that a student can earn for his / her current academic activity upon

obtaining a semester credit **in the 4th semester** is 120 points. The minimum number of points that a student must earn for his / her current academic activity in the 4th semester (to receive a semester credit) is 72 points (60% of 120 - maximum points).

Final assessment of the discipline «Ecotoxicology».

The points obtained by students in the final assessment of the discipline are converted into the traditional 4-point scale by the absolute criteria, which are given in the table below:

Score from discipline	Score on 4-point rate
From 170 to 200 points	5
From 140 to 169 points	4
From 139 to 120 points	3
Below the minimum number of points which student must get	2

To determine the ECTS score, a ranking is made by the number of points earned by the student in the final assessment of the discipline.

Ranking with assignments of grades "A", "B", "C", "D", "E" is made for students of this course, who study in one specialty and have successfully completed the study of the discipline.

The objectivity of the evaluation of students' educational activity is verified by statistical methods (the correlation coefficient between the ECTS grade and the national scale grade).

Conversion of rating point to ECTS success scale :

ECTS grade	Statistics	Calculations
A	Top 10%	200 - 110 = 90 points 90 b. × 10% = 9 b.
B	Next 25%	90 b. × 25% = 23 b.
C	Next 30%	90 b. × 30% = 27 b.
D	Next 25%	90 b. × 25% = 23 b.
E	Last 10%	90 b. × 10% = 9 b.
F _x	Resubmission	The gap between "folded - not folded" and the minimum tolerance score
F	Compulsory re-training	Less than the minimum tolerance score

Students who have received grades F_x and F ("unsatisfactory") are not included in the list of students who are ranked. Students with an F_x score automatically receive an "E" grade upon transfer. Upon receipt of the F_o rating, it is necessary to undergo a second course of study.

Mark written by ECTS can't be converted into traditional scale because the ECTS scale and 4-point scale are independent (do not coincide).

9. Course policies

Attendance policies outline student requirements for participation, whether in a physical classroom or digital learning experience. These policies will generally outline how often a student must attend a course and the consequences of not fulfilling that obligation.

Students are expected to attend all classes and course activities for which they are registered. Any class meeting missed, regardless of cause, reduces the opportunity of learning and may adversely affect a student's achievement in the course. Students are required to attend at least 90% of the class meetings in order to receive credit for the course. An accurate record of attendance will be kept for each course. If a student misses one- third or more of a class session, the student will be

counted absent. Three tardiest will count as one absence. Leaving early is the same as being tardy.

If a student misses a class, it is THEIR responsibility to make up the material missed.

Academic Dishonesty. Adherence to academic integrity by students involves:

1. Independent performance of educational tasks, tasks of current and final control of learning outcomes (for persons with special educational needs this requirement is applied taking into account their individual needs and opportunities);

2. References to sources of information in the case of the use of ideas, developments, statements, information; Compliance with copyright and related rights legislation;

3. Providing reliable information about the results of their own (scientific, creative) activities, used research methods and sources of information.

Violations of academic integrity are: academic plagiarism, self-plagiarism, fabrication, falsification, write-off, deception, bribery, biased evaluation.

For violation of academic integrity, students may be involved in re-assessment.

Personal technology policies focus on the permitted use of technology within the classroom.

Per university policy and classroom etiquette; mobile phones, iPods, etc. must be silenced during all classroom and lab lectures. Those not heeding this rule will be asked to leave the classroom/lab immediately so as to not disrupt the learning environment. Please arrive on time for all class meetings. Students who habitually disturb the class by talking, arriving late, etc., and have been warned may suffer a reduction in their final class grade.

10. Recommended Literature

Compulsory course literature

1. Закон України "Про охорону навколишнього природного середовища".
2. Закон України "Про оцінку впливу на довкілля".
3. Екологічна токсикологія: навчально-методичний посібник / Мирослава Петровська. - Львів : ЛНУ імені Івана Франка, 2014. - 116 с.
4. Білявський Г. О. Основи екології: теорія та практикум : [навч. посібник] / Г. О. Білявський, Л. І. Бутченко, В. М. Навроцький. - К. : Лібра, 2002. - 352 с.
5. Григор'єва Л. І. Іонізуюче випромінювання та його вплив на організм людини : [навч. посібник] / Л. І. Григор'єва, Ю. А. Томілін, І. М. Рожков. - Миколаїв : Вид-во МДГУ ім. Петра Могили, 2008. - 137 с.
6. Григор'єва Л. І. Нормування антропогенного навантаження на навколишнє середовище : [навч. посібник] / Л. І. Григор'єва. - Миколаїв : Вид-во МДГУ ім. Петра Могили, 2005. - 174 с.
7. Джигирей В. С. Екологія та охорона навколишнього природного середовища : [навч. посібник] / В. С. Джигирей. - 2-ге вид. - К. : Знання, КОО, 2002. - 203 с.
8. Екологічна біохімія : [навч. посібник] / [В. М. Ісаєнко, В. М. Войціцький, Ю. Д. Бабенюк та ін.]. - К. : Вид-во НАУ, 2005. - 437 с.
9. Екотоксикологія : [навч. посібник] / [В. В. Снітинський, П. Р. Хірівський, П. С. Гнатів та ін.]. - Херсон : Олді-плюс, 2011. - 330 с.
10. Исидоров В. А. Введение в курс химической экотоксикологии : [учеб. пособие] / В. А. Исидоров. - СПб. : Изд-во СПб. ун-та, 1997. - 88 с.
11. Исидоров В. А. Введение в химическую экотоксикологию : [учеб. пособие] / В. А. Исидоров. - СПб. : Химиздат, 1999. - 142 с.
12. Каплин В. Г. Основы экотоксикологии / В. Г. Каплин. - М. : Колос, 2006. - 232 с.
13. Кораблева А. И. Введение в экологическую токсикологию / А. И. Кораблева, Л. Г. Чесанов, А. Г. Шапарь. - Днепропетровск : Центр экон. образования, 2001. - 308 с.

14. Некос В. Ю. Нормування антропогенного навантаження на навколишнє природне середовище : підручник [для студ. екологічних спеціальностей вищ. навч. закладів] -2-ге вид., доп. і перероб. / [В. Ю. Некос, Н.В. Максименко, О. Г. Владимірова и др.] // - Х. : ХНУ імені В. Н. Каразіна, 2007. - 288 с.
15. Немий С. Основи екологічної токсикології / С. Немий, Л. Коневич ; за ред. О. М. Адаменка. - Івано-Франківськ : Полум'я, 2000. - 180 с.
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18. Трахтенберг И. Книга о ядах и отравлениях / И. Трахтенберг. - Киев : Наук. думка, 2000. - 368 с.
19. Трахтенберг И. М. Тяжелые металлы во внешней среде: Современные гигиенические и токсикологические аспекты / И. М. Трахтенберг, В. С. Колесников, В. П. Луковенко. - Минск : Наука і тэхніка, 1994. - 285 с.
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22. Экологическая токсикология / [И. М. Росток, И. М. Турияница, З. Й. Фабри и др.]. - Ужгород : Патент, 2001. - 312 с.

Auxiliary literature

1. Військова токсикологія, радіологія та медичний захист: Підручник / За ред. Ю.М.Скалецького, І.Р. Мисули - Тернопіль: Укрмедкнига. - 2003 р. - 362 с.
2. Гідроекологічна токсикометрія та біоіндикація забруднень / за ред. І. Т. Олексів, Л. П. Брагінського. - Львів : Світ, 1995. - 440 с.
3. Гончарова Н.В. Биомониторинг : учеб.-метод. Пос. / Н.В. Гончарова. - Минск: МГЭУ им. А.Д. Сахарова, 2011. - 60 с.
4. Методика екологічної оцінки якості поверхневих вод за відповідними категоріями / [В. Д. Романенко, В. М. Жукинський, О. П. Оксіюк та ін.]. - К. : СИМВОЛ-Т, 1998. - 28 с.
5. Некос А. Н. Екологія людини : [підручник] / А. Н. Некос, Л. О. Багорова, М. О. Клименко. - Х. : ХНУ імені В. Н. Каразіна, 2013. - 336 с.
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12. Методичні вказівки для практичних занять студентів по дисципліні "Основи екологічної токсикології" [Електронний ресурс]. - Харків, 2006. - Режим доступу : files.khadi.kharkov.ua/.
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11. Equipment, logistics and software of the discipline / course

Textbooks, computers

12. Additional information

The time and place (specialized, classroom, laboratory, studio, etc.) of the discipline is determined in accordance with the approved schedule. All compulsory and auxiliary literature is available as e-books.

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