МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
Львівський національний університет імені Івана Франка
Біологічний факультет
Кафедра екології

Затверджено
на засіданні кафедри екології
біологічного факультету
Львівського національного
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Завідувач кафедри
доц. Мамчур З.І.

Силабус навчальної дисципліни

ECOLOGICAL TOXICOLOGY

що викладається в межах ОПП <u>ІІ (магістерського)</u> рівня вищої освіти для здобувачів спеціальності <u>101 “Екологія”</u>

Львів 2020

Course title	**Ecological Toxicology**
Address of teaching the course	Saksagansky Str., 1, 79005 Lviv
Faculty and department	Faculty of Biology, Department of Ecology
Field of knowledge, code and name of the specialty	101 Ecology, 10 Natural Sciences
Teachers of the course	Antonyak Halyna Leonidivna, Dr.Sc., Prof., Department of Ecology
Contact information of teachers	https://bioweb.lnu.edu.ua/employee/antoniak-h-l halyna_antonyak@yahoo.com
Consultations	Consultations are held on the day of lectures / practical classes (by prior arrangement). There are also online consultations through ZOOM and in the MOODLE system.
Course page	http://e-learning.lnu.edu.ua/course/view.php?id=2954
Course information	The course 'Ecological toxicology' is aimed at studying the harmful effects of toxic substances and anthropogenic pollutants on the environment, biotic components of natural ecosystems (organisms, populations, and communities), urban ecosystems and agroecosystems.
Short annotation of the course	'Ecological toxicology' is a normative discipline in the master's educational program in the specialty 101 Ecology. The discipline is taught in the 1st year of study (1st semester) in the amount of 5 credits (according to the European Credit Transfer System ECTS).
The aims and objectives of the course	As a result of studying the discipline 'Ecological toxicology' students will acquire the necessary knowledge and skills to assess the pollution of environmental components by various groups of toxicants and the harmful effects of pollutants on the biotic component of ecosystems, as well as to conduct toxicological monitoring of the environment. These skills will be useful when creating environmental projects and programs, when assessing levels of environmental pollution and implementing measures to prevent the impact of anthropogenic pollutants on the environment.
Literature for the study	• Environmental and Pollution Science (Third Edition). – Acad. Press, 2019. • An Introduction to Environmental Toxicology (Third Edition) by Michael H Dong. – 2014. • Casarett & Doull's Toxicology: The Basic Science of Poisons, Eighth Edition (Casarett & Doull's Toxicology) by Curtis Klaassen. – 2013. • Environmental Toxicology (Cambridge Environmental Chemistry Series) by David A. Wright and Pamela Welbourn. – 2002. • Environmental Toxicology: Biological and Health Effects of Pollutants (Third Edition) by Ming-Ho Yu and Humio Tsunoda. – 2011. • Zakrzewski S.F. Environmental Toxicology. – 2002. • Ecosystems and Human Health: Toxicology and Environmental Hazards (Second Edition) by Richard B. Philp. – 2001. • Shaw I., Chadwick J. Principles of Environmental Toxicology. – 1998.

	Internet resources: 1. https://www.journals.elsevier.com/ecotoxicology-and-environmental-safety 2. https://www.journals.elsevier.com/current-opinion-in-toxicology 3. https://www.nature.com/subjects/ecotoxicology 4. https://www.thebts.org/careers/industrial-toxicology/ 5. https://www.imedpub.com/scholarly/ecotoxicology-journals-articles-ppts-list.php 6. https://guides.lib.berkeley.edu/publichealth/envirohealth/orgs
Course duration	150 hours
Number of teaching hours	**48** hours of faculty-led learning (32 hours of lectures, 16 hours of practical classes), 102 hours of self-study work.
Expected learning outcomes	Upon completion of this course, students will know: • basic principles of ecological toxicology; • the main groups of industrial toxicants and toxic substances used in the agricultural practice; • sources of environmental toxicants; • biological agents that can have harmful effects on living organisms; • health and environmental effects of persistent organic pollutants; • health and environmental effects of heavy metals; • biomagnification and trophic transport of pollutants in the food chain; • basics of toxicokinetics and toxicodynamics of toxicants in the living systems; • principles of standardization and regulation of the content of toxic substances in the components of natural environment; • legislative acts and regulations governing environmental and occupational risks; • international environmental health issues. **Students will acquire the following skills:** • assessment of environmental hazards from toxic substances that pose a threat to ecosystems, human health and safety; • assessment of the main sources and types of environmental hazards in water, air and soil and their direct / indirect impact on ecosystems and human health; • carrying out toxicological monitoring of environmental components; • using the current methods for determining of the concentration of toxic substances in the components of natural environment; • discussion and development of various approaches to environmental pollution risk management and public awareness of environmental risks; • elaboration of project documentation related to the assessment of the environmental toxicity of various pollutants; • elaboration of the environmentally reasonable propositions for the reducing of use of toxic chemicals in agriculture; • development of projects aimed at preventing the impact of anthropogenic pollutants on the environment.

Keywords	Ecological toxicology, ecotoxicology, environmental pollutants, environmental toxicity, environmental risk, natural toxins, organic pollutants, xenobiotics, heavy metals.
Course format	Stationary / distance learning
	Lectures, practical trainings and consultations.
Course content	Topics are presented in the table.
Form of final control	Final evaluation is based on the results of tests carried out at the end of each study module, on the results of practical classes and on the results of self-study work.
Prerequisites	The course is based on the knowledge gained in the study of academic disciplines at the bachelor's level in the specialty 101 Ecology, or requires a basic knowledge of disciplines in the field of biology and ecology necessary to understand the toxicological aspects of ecology.
Teaching methods and techniques to be used	Presentations, lectures, problem lectures, discussion. Working in the MOODLE system, e-learning.
Necessary equipment	Personal computer, commonly used computer programs, a projector, devices of the Ecology Department's laboratory.
Evaluation criteria (separately for each type of educational activity)	**Evaluation** (point scoring). The points gained during the current testing, self-study work (presentations) and module control are taken into account. The assessment is carried out on a 100-point scale. Points are awarded according to the following ratio: practical classes – 40 points (8 lessons × 5 = 40 points); modular control (3 modules of 15 points – 45 points in total); presentations based on the results of self-study work – 15 points. The final maximum number of points is 100. **Academic virtue**: students' presentation works are exclusively original results of self-processing of material. Any form of violation of academic virtue and plagiarism is not tolerated.
Test questions	The aims and basic principles of ecological toxicology; the main groups of environmental toxicants; sources of toxicants in the environment; mechanisms of interaction of toxic substances with a living organism; basics of toxicokinetics and toxicodynamics of toxicants in the living systems; mechanisms of toxicity by which environmental agents may cause human illness and injury; the exposure-dose relationship in the development of illnesses; basic mechanisms of poisoning in animals and humans; health hazards of xenobiotics in the environment; health and environmental effects of persistent organic pollutants; bioaccumulation of pollutants in living organisms; biomagnifications of pollutants in the food chains; health and environmental hazard of major groups of pesticides used in agriculture; toxicity mechanism and health effects of heavy metals; main groups of natural toxins and their effects; measures to prevent and reduce the negative impact of ecotoxicants on the environment; principles of regulation of the content of toxic substances in the environmental components; permissible levels of toxic substances in the atmosphere, aquatic environment and soil.

	Materials are available at: http://e-learning.lnu.edu.ua/course/view.php?id=2954
Questionnaire	Questionnaire for assessing the quality of the course will be provided upon completion of the course on the website: http://e-learning.lnu.edu.ua/course/view.php?id=2954

Course content

Module 1. General problems of ecological toxicology			
1	Subject, aims, and problems of ecological toxicology; the concepts and terminology in ecotoxicology. *Practical classes:* History of toxicology and ecological toxicology.	*Lectures– 2 hours, practical classes – 2 hours, self-study work – 6,5 hours*	1 week
2	Structure of toxic substances and selectivity of their action.	*Lectures– 2 hours, self-study work – 6,5 hours*	1 week
3	Main groups of chemicals that can act as ecotoxicants and their ecotoxicological characteristics. *Practical classes:* Toxic effects of environmental pollutants.	*Lectures– 2 hours, practical classes – 2 hours, self-study work – 6,5 hours*	1 week
4	Risk assessment of xenobiotics and other pollutants in the environment.	*Lectures– 2 hours, self-study work – 6,5 hours*	1 week
5	Control of toxic substances and prevention of environmental pollution. *Practical classes:* Legislative acts and documents in the field of environmental protection.	*Lectures– 2 hours, practical classes – 2 hours, self-study work – 6,5 hours*	1 week
Module 2. Main groups of environmental toxicants and their effects			
6	Industrial pollutants and their environmental effects; effects of road transport on the environment.	*Lectures– 2 hours, self-study work – 6,5 hours*	1 week
7	Persistent organic pollutants: their effects on human health and on the environment. *Practical classes:* Toxic effects of certain persistent organic substances.	*Lectures– 2 hours, practical classes – 2 hours, self-study work – 6,5 hours*	1 week
8	Toxicity mechanism and health effects of heavy metals.	*Lectures– 2 hours, self-study work – 6,5 hours*	1 week
9	Health and environmental hazard of major groups of pesticides used in agriculture. *Practical classes:* Impact of the use of pesticides on the quality of agricultural products.	*Lectures– 2 hours, practical classes – 2 hours, self-study work – 6,5 hours*	1 week
10	Main groups of natural toxins and their effects. *Practical classes:* Toxins produced by microorganisms, plants and animals.	*Lectures– 4 hours, practical classes – 2 hours, Self-study work – 11 hours*	2 weeks
11	Bioaccumulation of pollutants and their biomagnifications in the food chains.	*Lectures– 2 hours, self-study work – 6,5 hours*	1 week

Module 3. Interaction of ecotoxicants with a living organism			
12	Mechanisms of interaction of toxic substances with a living organism. *Practical classes:* Mechanisms of toxicity of environmental pollutants.	*Lectures– 2 hours, practical classes – 2 hours, self-study work – 6,5 hours*	1 week
13	Toxicokinetics and toxicodynamics of toxicants in the living systems.	*Lectures– 2 hours, self-study work – 6,5 hours*	1 week
14	Transformation and detoxication of xenobiotics in living organisms and in the abiotic environment. *Practical classes:* Organisms that are involved in the transformation of xenobiotics in soil and water.	*Lectures– 2 hours, practical classes – 2 hours, self-study work – 6,5 hours*	1 week
15	Response of various groups of organisms to the action of toxic substances.	*Lectures– 2 hours, self-study work – 6,5 hours*	1 week