



Human ecology

Working program of the academic discipline (Syllabus)

Details of the academic discipline

Level of higher education	<i>first (undergraduate)</i>
Branch of knowledge	<i>1 0 Natural sciences</i>
Specialty	<i>101 Ecology</i>
Educational program	<i>Ecological safety</i>
Discipline status	<i>Mandatory</i>
Form of education	<i>full-time (day)/distance/mixed</i>
Year of training, semester	<i>3rd year, spring semester</i>
Scope of the discipline	<i>8.5 (255)</i>
Semester control/ control measures	<i>Exam</i>
Lessons schedule	<i>7 hours per week (4 hours of lectures and 1 hour of practical classes, 2 hours of laboratory classes)</i>
Language of teaching	<i>Ukrainian</i>
Information about the head of the course / teachers	Lecturer: https://eco-paper.kpi.ua/pro-kafedru/vykladachi/nosachova-yuliya-viktorivna.html https://eco-paper.kpi.ua/pro-kafedru/vykladachi/vember-valeriya-volodimirivna.html https://eco-paper.kpi.ua/pro-kafedru/vykladachi/ovsyankina-viktoriya-oleksijivna.html
Placement of the course	https://do.ipk.kpi.ua/

Program of educational discipline

1. Description of the educational discipline, its purpose, subject of study and learning outcomes

1.1. The purpose of the educational discipline.

The purpose of the educational discipline is developing the following competencies of the students:

- Knowledge and understanding of the theoretical fundamentals of ecology, environmental protection and balanced nature management;
The ability to critically understand basic theories, methods and principles of natural sciences
- Ability to assess the impact of technogenesis processes on the state of the environment and to identify environmental risks associated with production activities;
- The ability to master international and domestic experience in solving regional and cross-border environmental problems;
- The ability to apply up-to-date methods and means of monitoring the state of atmospheric air, natural waters, soils and biota, to determine the level of contamination of natural and industrial materials with radioactive elements, to master methods for assessing the impact of adverse factors on living organisms, to determine the adaptive capabilities of the human body in environmental conditions

- *The ability to distinguish the technological processes of production, to determine the sources and ways of entering the natural environment of harmful components, to assess their impact on human health and the quality of the environment*

1.2. The main tasks of the academic discipline.

According to the requirements of the educational-professional and educational-scientific program, after mastering the academic discipline, students must demonstrate the results of their studies:

- *To understand the basic environmental laws, rules and principles of environmental protection and nature management;*
- *To understand the basic concepts, theoretical and practical problems in the field of natural sciences that are necessary for analysis and decision-making in the field of ecology, environmental protection and optimal use of nature*
- *To use the management principles on which the environmental safety system is based*
- *To solve problems in the field of environmental protection using generally accepted and / or standard approaches and international and national experience*
- *To be able to predict the impact of technological processes and industries on the environment*
- *To participate in the development and implementation of projects aimed at optimal management and treatment of industrial and municipal waste*
- *To be able to explain the social, economic and political consequences of implementing environmental projects*
- *To raise the professional level by continuing education and self-education;*
- *To carry out laboratory researches with use of modern devices, to provide sufficient accuracy of measurement and reliability of results, to process the obtained results*
- *To determine the class of toxicity and hazard of chemical pollutants according to the parameters of toxicometry, to determine the impact of radiation on the environment, to calculate the maximum allowable discharges and maximum allowable emissions*

Pre-requisites and post-requisites of the discipline (place in the structural and logical scheme of training according to the relevant educational program)

Studying of the discipline "Human Ecology" directly relies on at least the following disciplines belonging to the structural and logical scheme of the bachelor's training: "Chemistry with the basics of biogeochemistry", "Biology", "Special sections of biogeochemistry", "General ecology", "Hydrology", "Meteorology and climatology", Course project on atmospheric protection, "Geodynamics of the ecological environment". The acquired knowledge and skills are used in the study of the following disciplines: "Modeling and forecasting of the state of the environment . Basics of GIS", "Technoecology", "Environmental and natural and man-made safety" and others.

2. Content of the academic discipline

Part 1

Chapter 1. "Human ecology" as the newest interdisciplinary science

Topic 1. Subject and tasks of the course "Human Ecology" and its connection with other sciences

Chapter 2. Environmental factors and their impact on the human body

Topic 1. The influence of physical factors on human health and well-being

Topic 2. Chemical pollution of the environment and its consequences

Topic 3. Toxic effect and environmental factors. Toxicokinetics and toxicometry

Topic 4. Ecotoxicology. Violation of the state of ecosystems under the influence of man-made pollution

Chapter 3. Standardization of the content of harmful substances in the environment

Topic 1. Ways of determining the maximum permissible concentrations of chemical substances in the air and water of reservoirs

Topic 2. Standardization of the content of anthropogenic pollution in soils and food products

Topic 3. Principles of standardization of the content of pollutants in the environment in different countries of the world. Environmental risk

Chapter 4. Socioecology

Topic 1. Socioecology as the newest direction of "Human Ecology". Ecology of personality and society. Biological and social nature of man.

Part 2

Chapter 1. Concepts and principles of urban ecology.

Topic 1: Dynamics of urbanization and the state of ecology of the urban environment.

Topic 2: Functional zoning of city territories and environmental problems.

Chapter 2. Ecological and climatic aspects and mobile environments of urbanized territories.

Topic 1: Microclimate of the city.

Topic 2: Environmental and microclimatic assessment of the city territory.

Topic 3: Formation of the composition of the city's air.

Topic 4: Quality regulation and protection of the city's air environment.

Topic 5: Water environment of the city.

Topic 6: Quality regulation and protection of the city's water environment.

Chapter 3. Energy pollution of the urban environment.

Topic 1: Radiation status of the urban environment.

Topic 2: Protection of the city from acoustic and vibrational pollution.

Topic 3: Protection of the city from electromagnetic fields and video pollution.

Topic 4: Energy facilities of cities.

Chapter 4. Biocenoses, soils and waste management in urbanized areas.

Topic 1: Urban biocenoses and the impact of pollution on their health.

Topic 2: Measures of protection of the vegetation in urban areas.

Topic 3: Soil protection measures in urban areas.

Topic 4: Waste and the problem of its disposal in cities.

Chapter 5. Regulatory and legal aspects of optimization and protection of the urban environment.

Topic 1: Normative and legal framework for regulating of the quality of the urban environment.

Topic 2: Optimization of the urban environment and resource-saving technologies.

Topic 3: Environmental protection of buildings.

Part 3

Chapter 1. Introduction to the course "Radioecology"

Topic 1: Subject of the course "Radioecology". Radioactivity and life. Natural and artificial sources of radiation.

Chapter 2. Elements of nuclear chemistry in radioecology.

Topic 1: Concepts of nucleons and nuclides.

Topic 2: Ionizing radiation.

Topic 3: Nuclear reactions.

Chapter 3. Radioactive sources of the natural environment.

Topic 1: Radioactive isotopes.

Topic 2: Migration of radionuclides in the biosphere. Biological and food chains of radionuclide migration.

Chapter 4. The influence of radiation on objects of the natural environment.

Topic 1: Concept of ionization. Impact of ionizing radiation on biological objects. Direct effect of radiation on water. Indirect effect of radiation on biological objects. Radiation sensitivity of the main types of biocenoses

Chapter 5. Characteristics of radioactive emissions and their measurement units.

Topic 1: Dosimetry. Devices and methods of radiation control. The main factors of dose formation during the accident at the Chernobyl nuclear power plant.

Chapter 6. Radioecological aspects.

Topic 1: Continental, agricultural, freshwater and marine radioecology.

Topic 2: Human radioecology.

3. Educational materials and resources

Basic to Part 1

1. Vember V. V. *Methodical instructions for conducting practical (seminar) classes and performing independent work from the course "Human Ecology"*. - K., 2012. - 94 p.
2. Vember V. V., Ivanenko O. I. *Methodical instructions for performing laboratory work from the course "Human Ecology"*. - K., 2012. - 41 p.
3. Goncharenko M. S., Boychuk Yu. D. *Human ecology*. – Sumy: University Book, 2019. - 391 p.
4. Nosachova Yu. V., Ivanenko O. I., Vember V. V. *Environmental safety of engineering activity*. Kyiv: "Condor" Publishing House, 2020. - 294 p. 230 p.

Auxiliary to Part 1

7. Buravlyov E. P. *Safety of the environment*. — K., 2004. - 320 p.
8. Mykytyuk O. M., Zlotin O. Z., Brovdiy V. M. *Human Ecology*. - Kh.: OVS, 2004. - 254 p.
9. Mykhaylovska G. M. *Chemistry of toxic substances*. – Chernivtsi: Ruta, 2006.
10. Perepelitsa O. P. *Ecochemistry and endoecology of elements: a guide to environmental protection*. - K.: NUHT, 2004. - 736 p.
11. , Kryshchop E.A. etc. _ *Environmental toxicology. Tutorial*. — Kh.: Khnau, 2016. — 349 p.
12. Radovenchyk V. M., Gomelya M. D. *Solid waste: collection, processing, storage. Tutorial*. - Kyiv: Condor, 2010. - 549 p.
13. I.M. Trus, Y.V. Radovenchyk, M.D. Gomelya. *Ecological aspects of environmental quality management: Textbook*. – Kyiv: Polytechnic, 2019. – 210 c .
14. Khobotova E.B., Ukhanyova M.I. *Human ecology : Synopsis of lectures*. - Kharkiv: Kharkiv National Automobile and Road University, 2005. - 75 p.

Basic to Part 2

1. *Urboecology: a textbook for students of higher educational institutions / V.P. Kucheryavy - Lviv, "New World-2000" Publishing House, 2021. - 460 p.*
2. *Urboecology and phytoremediation: study guide / L.M. Filipova, A.P. Stadnyk, V.V. Matskevich et al. – Bila Tserkva, 2018. – 214 p.*
3. *Urboecology / I. A. Vasylenko, O. A. Pivovarov, I. M. Trus, A. V. Ivanchenko. Dnipro: Accent PP, 2017. 309p.*

Auxiliary to Part 2

4. Solukha B.V., Fuchs G.B. *Urban ecology*. - K.: KNUBA, 2004. - 338 p.
5. Kucheryavy V. O. *Phytomelioration*. - Lviv: Svit, 2003. - 539 p.
6. Chaika V.E. *Urboecology*. - Vinnytsia: 1999. - 368 p.
7. Bezlyubchenko O.S. *Planning and improvement of cities: education. manual. for students of all forms of education and students of the second higher education in the field of training 0921*

- (6.060101) - "Construction" / O. S. Bezlyubchenko, O. V. Zavalnyi, T. O. Chernosova; Hark. national Acad. urban farm - Kh.: KhNAMG, 2011. - 191 p.
8. Law of Ukraine "On Improvement of Settlements" dated September 6, 2005 No. 2807-IV// VVRU — 2005 — No. 49 — Art. 527.
 9. Law of Ukraine "On Territorial Planning and Development" dated April 20, 2000 No. 1699-III // VVRU — 2000 — No. 31 — Art. 250.
 10. The Law of Ukraine "On the General Planning Scheme of the Territory of Ukraine" dated February 7, 2002, No. 3059-III // VVRU — 2002 — No. 30 — Art. 204.
 11. Law of Ukraine "On the Basics of Urban Planning" dated November 16, 1992 No. 2780-XI // VVRU — 1992 — No. 52 — Art. 683.
 12. Methodological instructions for independent work in the discipline "Urboecology" / Comp.: O. M. Horokhovskiyi. - K.: NTUU "KPI", 2012. - 47 p.

Basic to Part 3

1. Grodzinsky D. M. Radiobiology: Textbook. - K.: Lybid, 2000. — 448 p.
2. Yu.O. Kutlahmetov etc. Fundamentals of radioecology: teaching. Manual - K.: Higher School, 2003. - 319 p.
3. Krysenko A. D., Ovsyankina V. O., Krysenko T.V. Radioecological aspects: Education. manual - K.: Polytechnic Military Academy, 2012.
4. Methodological instructions for independent work on the course "Radioecology" (part 1. Radioactivity of the external environment and elements of nuclear chemistry in radioecology) for students of the training direction 6.070801 "Ecology and environmental protection" / Comp.: A. D. Krysenko, V. O. Ovsyankina, T. V. Krysenko. - K.: NTUU "KPI", 2010. - 48 p.
5. Methodical instructions for performing laboratory work for students of the specialty 7.070801 "Ecology and environmental protection" on the course "Radioecology" / Comp.: A. D. Krysenko, V. O. Ovsyankina, A. O. Fomenko. - K.: NTUU "KPI", 2010. - 44 p.

Auxiliary to Part 3

6. Radiation safety standards of Ukraine (NRBU-97).
7. Heinrich D., Gergt M. Radioactivity // Ecology: dtv-Atlas. - K.: Znannia-Press, 2001. - P. 58-59; 202-207
8. Agricultural radioecology: Textbook / Edited by Academician of the National Academy of Sciences of Ukraine I.M. Gudkova - K.: Lira-K Publishing House, 2017. - 268 p.
9. Klymenko M. O., Klymenko O. M., Klymenko L. V. Radioecology: textbook. — Rivne: NUVHP, 2020. — 304 p.

5. Methods of mastering an educational discipline (educational component)

Lecture classes

Lectures are aimed at:

- *provision of modern, integral, interdependent knowledge in the discipline "Human Ecology", the level of which is determined by the target attitude to each specific topic;*
- *ensuring creative work of students together with the teacher during the lecture;*
- *education of students' professional and business qualities and development of their independent creative thinking;*
- *forming the necessary interest in students and providing direction for independent work;*
- *definition on the current level of development of science and technology in the field of environmental protection, forecasting their development for the coming years;*
- *reflection of the methodical processing of the material (highlighting of the main provisions, conclusions, recommendations, their wording is clear and adequate);*
- *the using of visual materials for demonstration, combining them, if possible, with the demonstration of results and samples;*
- *teaching research materials in a clear and high-quality language with observance of structural and logical connections, clarification of all newly introduced terms and concepts;*
- *accessibility for perception by this audience.*

No. z/p	The name of the topic of the lecture and a list of the main questions (a list of didactic tools, references to the literature and tasks on the IWS)	Hour
Part 1		
1	<p>Subject and tasks of the course "Human Ecology". Its connection with other sciences . Basic concepts</p> <p>The subject of "Human ecology" and its connection with other sciences, the main directions and structure of the course. The history of the emergence and basic concepts of the scientific discipline "Human Ecology". Priority environmental pollutants.</p> <p><i>Literature : 1, 4, 5, 14, 17.</i></p> <p><i>Task for independent work:</i> Draw diagrams and make a table showing various directions and subdivisions of the newest complex discipline "Human Ecology". Reflect its relationships with other scientific disciplines and fields of human activity.</p>	2
2	<p>Man as a whole organism and his interaction with the surrounding environment</p> <p>Redistribution and transformation of substances in the human body. Biogeochemical cycles in the environment. The concept of harmful and dangerous substances. Conditions for the formation of substances with mutagenic, carcinogenic and general toxic effects.</p> <p><i>Literature : 6, 8, 9, 12, 16.</i></p> <p><i>Task for independent work:</i> Repeat the material of the lecture, think through and make a list of substances that have the most negative impact on health.</p>	2

3	<p>Adaptation and homeostasis of the body's environment Anatomical, physiological and molecular mechanisms of maintaining homeostasis. Limits of adaptation. The concept of the relationship between the processes of accumulation, adaptation and removal of toxic substances from the body. <i>Literature</i> : 6, 9, 10, 12, 15, 19. <i>Task for independent work:</i> Repeat the material of the lecture, draw a diagram of the main routes of entry of toxic substances into the human body and the routes of removal of toxic products.</p>	2
4	<p>Chemical factors of environment and their impact on human health The relationship between the chemical structure of organic and inorganic substances and their toxicity. The rule of homologous series. Toxicity receptors. Transformation of poisonous compounds in the body. The concept of lethal synthesis. Cumulation. Specific and non-specific effect of toxic substances. Peculiarities of the "dose-effect" interaction. Combined and complex action of environmental pollutants. Classification of dangerousness and toxicity of substances according to toxicometric indicators. <i>Literature</i> : 13, 18, 20, 21. <i>Tasks for independent work:</i> Process and systematize information about the possible effects of noise, electromagnetic and ionizing radiation on human health.</p>	2
5	<p>Chemical pollution of the environment and its consequences Chemical technogenic pollution of the environment and their classification. Peculiarities of distribution and accumulation of chemical pollutants in the environment and their biological effect. The problem of disposal of household and industrial waste . <i>Literature</i> : 4, 13, 14, 18, 21. <i>Tasks for independent work:</i> The relationship between the chemical structure of organic and inorganic substances and their toxicity. The rule of homologous series.</p>	2
6	<p>Toxic effect and environmental factors. Toxicokinetics and toxicometry The toxic effect as the result of the interaction of the organism, the poison and the environment. The influence of environmental factors on the action of harmful substances. Homeostatic plateau and tolerance of organisms to the action of poisons. Toxicokinetics. Ways of penetration of harmful substances into the body. Transport of poisonous substances through cell membranes. Passage of poisons through the body. Types of poisoning. Toxicometry. Parameters of toxicometry (lethal and medium-lethal doses, threshold of harmful effect, zone of acute and chronic effect, OBRD, KMIO). The limit-permissible concentration is the legal basis of sanitary control . <i>Literature</i> : 13, 14, 16, 18, 21. <i>Task for independent work:</i> What toxic metabolic products are released by different taxonomic groups of living organisms? Ecological significance of similar secondary metabolites. Toxicity receptors. Transformation of poisonous compounds in the body. The concept of lethal synthesis. Cumulation. Specific and non-specific effects of toxic substances. Peculiarities of the "dose-effect" interaction. Combined and complex action of environmental pollutants. Classification of dangerousness and toxicity of substances according to toxicometric indicators.</p>	2

7	<p>Ecotoxicology. Violation of the state of ecosystems under the influence of man-made pollution</p> <p>Ecotoxicology. Impact of harmful substances on populations and groups. Disruption of ecosystems under the influence of human activity. Movement and concentration of harmful substances along trophic chains. Man as the top of ecological pyramids. Impact of man-made pollution on people's living conditions and health .</p> <p><i>Literature</i> : 1, 4, 8, 11, 13, 14, 18 , 2 1-23.</p> <p><i>Tasks for independent work</i>: Bioindication and biotesting. Determination of the toxicity of water, soil, the presence of toxic substances in the air using phyto-, zoo- and microbial tests.</p>	2
8	<p>Ways of determining of the maximum permissible concentrations of chemical substances in the air and water of reservoirs</p> <p>Standardization of the content of pollutants in the air. Ways of establishment of the MPC of chemical substances in atmospheric air and in the air of the working area. The OBRD indicator as a temporary standard. Standardization of the content of pollutants in the water of reservoirs. Indicators of harmfulness at setting of the MPC in water .</p> <p><i>Literature</i> : 1, 5, 11, 13, 14, 21.</p> <p><i>Tasks for independent work</i>: Regulation of the content of chemical pollutants in reservoirs for fish farming. Ecological approaches to the establishment of MPCs.</p>	2
9	<p>Standardization of the content of anthropogenic pollutants in soils and food products</p> <p>Indicators of harmfulness at establishing of the MPC of pollutants in soils. Regulation of the content of toxic substances in food products. The impact of various pollutants on the human body.</p> <p><i>Literature</i> : 1, 3, 5, 7, 11-14, 16, 20-23.</p> <p><i>Tasks for independent work</i>: Preparation for the MKR and the exam.</p>	2
Part 2		
1	<p>Dynamics of urbanization and ecological state of the urban environment</p> <p><i>The city as an artificial habitat. Features of urban systems in comparison with settlements of other types. Urban agglomerations. Large industrial centers. Global dynamics of urbanization. Natural, man-made, socio-economic and socio-demographic subsystems. Flows of energy, matter and information through the urbosociogeosystem.</i></p> <p><i>Literature</i>: [1] p. 5-12; [3] p. 9-23; [6] p. 11-37.</p> <p><i>Tasks on IWS</i>: Approaches to the study of cities: geographical, economic, sociological, engineering, general-ecological, cultural-anthropological. [6] p. 1-11.</p>	2
2	<p>Functional zoning of city territories and environmental problems</p> <p><i>Household, landscape and recreational, industrial. Three models of spatial urban structure. Natural, economic, socio-psychological factors affecting on the location of urban settlements. Automobilation, spatial organization of territories, natural and man-made danger. Ways of sustainable development of the urban environment.</i></p> <p><i>Literature</i>: [1] p. 12-22; [3] p. 23-25; [6] p. 309-315</p> <p><i>Tasks on IWS</i>: Environmental problems of Ukrainian cities. [1] p. 30-49; [6] p. 37-47</p>	2

3	<p>Microclimate of the city</p> <p>Bioclimatic conditions of the city territory (insolation, heat, wind, humidity regimes of the city). Climatogram of the city. Ranking of microclimate types. Bioclimatic indicators: indices of the method of temperature scales (Misenard, Bodman, Hill), heat balance method.</p> <p>Literature: [1] p. 2 32 -2 40 ; [3] p. 107-108.</p> <p>Tasks on IWS:: Bioclimatic methods that are based on types of weather. [1] p. 245 -2 49 .</p>	2
4	<p>Ecological and microclimatic assessment of the city territory</p> <p>Method of integral ecological and microclimatic zoning of city territories. Integrated ecological map of the city. Environmental passport of the city. The influence of environmental factors on city development planning.</p> <p>Literature: [1] p. 390 - 402 ; [3] p. 261-265 , [8-11]</p> <p>Task on IWS:: Assessment of the impact of urban planning objects on the surrounding natural environment. [7] p. 25-48.</p>	2
5	<p>Formation of the composition of the city's air</p> <p>Standardization of atmospheric air quality. Comprehensive indicators and assessment of the state of the city's air environment.</p> <p>Literature: [1] p. 30-35; [3] p. 96-123; [6] p. 111-117.</p> <p>Tasks for IWS:: Sources of emissions of pollutants into the natural environment. [1] p. 249-268.</p>	2
6	<p>Quality regulation and protection of the air environment of the city</p> <p>Determination of the size of the sanitary protection zone. Methods of protecting the atmospheric air of cities: urban planning, administrative and organizational, techno-technological, regulatory and legal.</p> <p>Literature: [2] p. 116-131; [6] p. 107-111.</p> <p>Task on IWS:: Assessment of the impact of urban planning objects on the surrounding natural environment. [3] p. 231-233</p>	2
7	<p>Water environment of the city</p> <p>Indicators and assessment of the quality of natural waters. Sanitary and hygienic rationing. Water pollution index.</p> <p>Literature: [1] p. 35-42; [6] p. 100-107.</p> <p>Task on IWS:: Surface runoff from the territory of enterprises. [2] p. 22-32.</p>	2
8	<p>Quality regulation and protection of the water environment of the city</p> <p>Technical and technological methods of preparation of drinking water. Urban planning methods of protection of household and drinking water. Zones of sanitary protection. Waste water of the city.</p> <p>Literature: [3] p. 60-93, [7] p. 41-46.</p> <p>Tasks on IWS:: Technical and technological methods of sewage treatment. [3] p. 69-74.</p>	2
9	<p>Radiation status of the urban environment</p> <p>Characteristics of radioactivity of radionuclides and radiation doses. Radiation background and radioactivity of the building environment .</p> <p>Literature: [1] p. 47-49; [6] pp. 63-65.</p> <p>Tasks on IWS:: Measures of protecting of premises from radioactive contamination . [12] p. 51-64</p>	2

10	<p>Protection of the city from acoustic and vibrational pollution</p> <p>Noise and vibration pollution. Parameters and classification. Sources of education. Sound map of the city. The impact of acoustic pollution on a person.</p> <p>Literature: [1] p. 47-49; [3] p. 108-117</p> <p>Tasks on IWS:: Principles of noise and vibration reduction. [3] p. 239-241.</p>	2
11	<p>Protection of the city from electromagnetic fields and video pollution</p> <p>Sources and scale of electromagnetic and light pollution. Sanitary regulation, role and biological effect of electromagnetic fields.</p> <p>Literature: [3] p. 108-117</p> <p>Tasks on IWS:: Protection against electromagnetic pollution of urban population. [4] p. 54-58.</p>	2
12	<p>Energy facilities of cities</p> <p>Structure and development trends of energy supply. Objects of small power generation. Impact of energy facilities on the natural environment.</p> <p>Literature: [3] p. 124-145, [6] p. 225-231.</p> <p>Tasks on IWS:: Solar energy, wind energy. [3] p. 137-145.</p>	2
thirteen	<p>Urban biocenoses and the impact of pollution on their health</p> <p>Urbanized biotopes. Structure and dynamics of urban populations. Microbiotopes. Hemerobity of biotopes. Stages of formation of flora and fauna in urbanized areas. Reactions of organisms to the peculiarities of the conditions of the urbanized environment. The impact of pollution on human health.</p> <p>Literature: [1] p. 170-191; [3] p. 221-231; [6] p. 295-321.</p> <p>Tasks for IWS:: Methods of studying of the flora and fauna in the city. Biological rhythms and urbanization. Diseases of urbanization. [1] p. 331-355; [3] p. 221-227.</p>	2
14	<p>Measures of vegetation protect in urban areas</p> <p>Degradation and ecological function of vegetation in urban areas. Indicators and assessment of the ecological state of vegetation cover in urban areas.</p> <p>Literature: [1] p. 236-253; [3] p. 205-209.</p> <p>Tasks on IWS:: Basic mechanisms of adaptations of organisms and populations. [1] p. 312-319, 299-300.</p>	2
15	<p>Soil protection measures in urban areas</p> <p>Degradation and ecological function of urban soils. Indicators and evaluation of the ecological state of urban soils. Technogenically polluted territories.</p> <p>Literature: [1] p. 201-245; [6] p. 93-100.</p> <p>Tasks on IWS:: Restoration and protection measures. [6] p. 269-287.</p>	2
16	<p>Waste and the problem of its disposal in cities</p> <p>Industrial and household waste. Standards of accumulation of solid household waste (SWW). Morphological composition, sanitary and bacteriological properties of MSW. Collection and transportation. Technical and technological methods of processing. Disposal problems.</p> <p>Literature: [3] p. 146-164</p> <p>Tasks on IWS:: Solid waste landfills. [3] p. 156-159.</p>	2

17	<p>Regulatory and legal framework for regulating the quality of the urban environment</p> <p>Sources of the environmental legal framework: the constitution, laws in the field of nature using and environmental protection, decrees and orders of the president and government resolutions; normative acts of ministries and agencies; regulatory decisions of local self-government bodies. Assessment of the quality of urban land.</p> <p>Literature: [8-11].</p> <p>Tasks on IWS:: Land cadastral information. Protection of lands of objects of cultural heritage and historical settlements [8-11].</p>	2
18	<p>Optimization of the urban environment and resource-saving technologies</p> <p>Planning activities of industrial zones, residential areas, public complexes and places of mass recreation. Hygienic substantiation of the optimal population density and development. Monitoring of the urban environment.</p> <p>Literature: [1] p. 329-355; [3] p. 209-213.</p> <p>Tasks on IWS:: Using of underground space, multi-level junctions. Reconstruction of the city transport network. [3] p. 193-196</p>	1
19	<p>Environmental protection of buildings</p> <p>Meteorological indicators of indoor microclimate. Regulation of indoor air quality. Protection against harmful volatile substances, asbestos fibers included in construction and finishing materials. Norms and methods of noise and vibration protection of premises. Ecology of the residential environment.</p> <p>Literature: [3] p. 181-193; [7]</p> <p>Task on IWS:: "Smart House" technologies. "Ecohouse" concept. [3] p. 193.</p>	1
Part 3		
1	<p>Introduction to the course "Radioecology"</p> <p>The subject of the course "Radioecology". Connection of the course with other related sciences. Radioactivity and life.</p> <p>Literature: (1, p. 10, 2, p. 23, 7, p. 14)</p> <p>Tasks on IWS:. Interrelationship of radioecology and radiobiology.</p>	2
2	<p>Concepts of nucleons, nuclides. Ionizing radiation.</p> <p>Nucleons are the main components of the nuclear nucleus.</p> <p>Nuclides Stability of nuclides</p> <p>Types of ionizing radiation. Laws of radioactivity. Types of radioactive decay: α-decay, b) β-decay, d) electron capture</p> <p>Literature: (3, p. 6), (3, p. 7), (3, p. 30; 7, p. 20; 10; 11)</p> <p>Tasks on IWS:. emission of γ-quanta</p>	2
3	<p>Nuclear reactions</p> <p>The concept of nuclear reactions. Designation of a nuclear reaction. The main types of nuclear reactions in the natural environment:</p> <p>a) reactions generated by α-particles</p> <p>b) nuclear reactions are generated by neutrons</p> <p>Literature: (3, p. 81; 6; 11)</p> <p>Tasks on IWS:. Prevalence of isotopes in nature.</p>	2

4	<p>Radioactive isotopes</p> <p><i>Distribution of radioactive isotopes in nature. Terrestrial radioactivity. Radioactive families. Uranium fission. Radioactive rhon. Natural radioactive elements that are not included in the number of radioactive families. Radioactive potassium. Radioactive elements of atmospheric origin</i></p> <p><i>Literature: (1, p. 131; 3, p. 170; 8; 9), (2, p. 105; 5; 11)</i></p> <p><i>Tasks on IWS: Radioactive potassium.</i></p>	2
5	<p>Migration of radionuclides</p> <p><i>Migration of radionuclides in the biosphere. Biological and food chains of radionuclide migration.</i></p> <p><i>Literature: (1, p. 10; 2, p. 54, 105; 7)</i></p> <p><i>Tasks on IWS: The impact of ionizing radiation on a person.</i></p>	2
6	<p>Ionization</p> <p><i>Ionization. Impact of ionizing radiation on biological objects. Direct effect of radiation on water. Indirect effect of radiation on biological objects:</i></p> <p><i>a) effect of radiation on water</i></p> <p><i>b) the effect of radiation on living matter</i></p> <p><i>Radiation sensitivity of the main types of biocenoses</i></p> <p><i>Literature: (1, p. 113), (3, p. 65; 9, p. 139)</i></p> <p><i>Tasks on IWS: Radiation monitoring of external environments</i></p>	2
7	<p>Dosimetry</p> <p><i>Basic concepts of dosimetry. Devices and methods of radiation control. The main factors of dose formation during the accident at the Chernobyl nuclear power plant.</i></p> <p><i>Literature: (1, p. 75; 2, p. 19; 7; 8)</i></p> <p><i>Tasks on IWS: Peculiarities of the work of nuclear power enterprises.</i></p>	2
8	<p>Continental, agricultural, freshwater and marine radioecology. Human radioecology</p> <p><i>Basic elements and concepts of continental radioecology. Basic elements and concepts of agricultural radioecology.</i></p> <p><i>Basics of freshwater radioecology. Fundamentals of marine radioecology.</i></p> <p><i>Basic elements and concepts of human radioecology. Radioecology in nuclear energy.</i></p> <p><i>Literature: (2, 3, 8, 9)</i></p> <p><i>Tasks on IWS: Migration of radionuclides in agrocenoses</i></p>	2
9	<p><i>Final lecture.</i></p>	2
	<p>In total</p>	72

Practical training

As part of the teaching of the academic discipline "Human Ecology", practical classes are provided, which occupy more than 14 % of the classroom load. Practical classes cover a wide range of topics. They allow to understand better the lecture material, master the methods and calculations, find out the impact of certain groups of pollutants on living organisms and assess the degree of environmental risks.

The content of these classes and the method of conducting them contribute to the development of creative activity of the individual. They develop scientific thinking and the ability to use special terminology, allow you to check knowledge, in connection with which this type of work is an important means of operational feedback. Therefore, practical classes perform not only cognitive and educational functions, but are designed to promote the growth of students as future specialists in the field of ecology.

The main tasks of the cycle of practical classes are :

- ✓ to help students to systematize , fix and deepen knowledge of theoretical character;
- ✓ to teach them techniques of solving practical tasks;
- ✓ to promote students ' mastery of skills and skills in performing calculations, graphics and others types of tasks ;
- ✓ to teach students to work with scientific and reference literature , as well as regulatory documentation ;
- ✓ to form skills to learn independently , help to master methods , methods and receptions self-education and self-development

No. z/p	The name of the subject of the practical session and a list of the main questions (list of didactic support, references to the literature and tasks on the IWS:)	Hour
1	<p>The influence of physical, chemical and biological factors on human health and well-being. Homeostasis of the body's environment and environmental conditions. Optimal and permissible microclimate parameters. Impact of electromagnetic and noise pollution of the environment and their distant consequences. Ionizing radiation as a mutagenic factor.</p> <p><i>Literature</i> : 1, 4, 8, 12-14, 15, 17.</p> <p><i>Tasks for independent work</i>: Process and systematize information about the possible effects of noise, electromagnetic and ionizing radiation on human health.</p>	2
2	<p>The relationship between the chemical structure of organic and inorganic substances and their toxicity. The rule of homologous series. <i>Standardization</i> of the content of toxic substances in food products. The influence of chemical pollutants on the human body.</p> <p><i>Literature</i> : 1, 11, 13, 14.</p> <p><i>Tasks for independent work</i>: Ecotoxicology. Violation of the state of ecosystems under the influence of man-made pollution</p>	2
3	<p>Peculiarities of the "dose-effect" interaction. Combined and complex action of environmental pollutants. Classification of dangerousness and toxicity of substances according to toxicometric indicators.</p> <p><i>Literature</i> : 13 .</p> <p><i>Task for independent work</i>: Repeat the main features are characteristic of metabolism in the cell. What is their main difference from the phenomena and reactions occurring in objects of inanimate nature?</p>	2
4	<p>Toxicity receptors. Transformation of poisonous compounds in the body. The concept of lethal synthesis. Cumulation. Specific and non-specific action of toxic substances.</p> <p><i>Literature</i> : 14.</p> <p><i>Task for independent work</i>: Prepare reports on the principles of building the human body, levels of its organization and ways of maintaining homeostasis .</p>	2
5	<p>Ecological balance of the urbanized territory, calculation of indicators of demographic capacity of the territory [3]. Assessment of bioclimatic conditions of the city territory [3].</p> <p><i>Tasks on the IWS:: Capacity of the territory, demographic and ecological capacity. Evaluation of the city's development: score, index of sustainable development. [3] p.</i></p>	3

	<i>247-251. Bioclimatic methods that are based on types of weather. Assessment of the impact of urban planning objects on the surrounding natural environment. [3] p. 261-262; [12].</i>	
6	<p>Methods of assessing of the impact of enterprises, road transport and roads on the quality of atmospheric air in the city. Measurement of the main water quality indicators of the city's water supply sources and their comparative analysis. Calculation of the total volume of surface runoff and annual removal of pollutants from the urban area. Measurement, analysis and forecasting of acoustic pollution of the urban area. [3] p. 238-239</p> <p><i>Tasks for IWS:: Sources of emissions of pollutants into the natural environment. Assessment of the impact of urban planning objects on the surrounding natural environment. [3] p. 233-235. Surface runoff from the territory of enterprises. Technical and technological methods of sewage treatment. [2] p. 32-38. Measures of premises protecting from radioactive contamination. Principles of noise and vibration reduction. [3] p. 239-241.</i></p>	3
7	<p>Engineering-protective and architectural-planning phytomelioration. Sanitary and hygienic evaluation of green plants in settlements. Bioindication as an approach to environmental assessment.</p> <p><i>Task on IWS:: Protection from electromagnetic pollution of urban population. [1] p. 340-350, [2] p. 116-170.</i></p>	2
8	Writing MKR	2
	In total	18

Laboratory classes

As part of teaching of the educational discipline "Human Ecology", a large amount of laboratory work is provided, which make up 28% of the classroom load. As a supplement to the lecture course, they lay and form the basis of the bachelor's qualification in ecology . The purpose of laboratory work is to master methods related to the assessment of the quality of the natural environment and its suitability for human life and other living organisms; development of students' experimental skills, research approach to studying the subject, consolidation of theoretical material.

No. z/p	The name of the topic of laboratory work	Hour
1	<i>Determination of the organoleptic indicator of the harmfulness of substances in water using the example of phenol, sulfonol, and copper ions</i>	2
2	<i>Biotesting of drinking and wastewater using phyto- and zootests</i>	2
3	<i>Dustiness of territories and consequences of this phenomenon for the environment. Assessment of the toxicity of the dust fraction</i>	2
4	<i>Ecological assessment of the state of natural water bodies according to indices of chemical and biological oxygen consumption</i>	2
5	<i>Setting the indicator of signs of harmfulness of chemical substances in water according to their influence on the sanitary regime of the water body</i>	2
6	<i>Ecological normalization of oil content in the soil using the microbial amylolytic group</i>	2
7	<i>Determination of phytotoxicity of heavy metals</i>	2
8	<i>Examination of the presence and species diversity of lichens, as indicators of air purity, in zones of man-made pollution (along highways) and in conditionally clean zones of Kyiv (parks, outskirts of the city)</i>	2
9	<i>Assessment of the impact of motor vehicles on air quality</i>	2
10	<i>Safety techniques at working with sources of radioactive radiation in laboratory conditions</i>	2
11	<i>Express methods of determining the radioactivity of natural and environmental objects at different times of the year</i>	2
12	<i>Determination of γ - background in the indicated places of building No. 4 and beyond</i>	2
13	<i>Measurement of radioactivity of snow and water samples in special lead chambers</i>	2
14	<i>Carrying out a comparative analysis of the results of determining the radioactive background of the natural environment at different times of the year</i>	2
15	<i>Radiochemical analysis of natural materials and preparations</i>	2
16	<i>Registration of ionizing radiation using the ionization method</i>	2
17	<i>Registration of ionizing radiation using the scintillation method</i>	2
18	<i>Determination of the ^{40}K isotope content in natural and industrial materials</i>	2
	<i>In total</i>	36

6. Independent work of student

Independent work takes up 51% of the time of studying the credit module, including the completion of the HCW, preparation for writing the module control paper and preparation for the exam. The main task of students' independent work is the acquisition of scientific knowledge in the field of human health and environmental protection, which was not included in the list of lecture questions through personal information search; systematization and repetition of the passed material; formation of active interest and creative approach to learning. In the process of independent work within the credit module "Human

Ecology", the student must learn to deeply analyze the existing problem under consideration, process it and come to his own well-founded conclusions.

No. z/p	The name of the topic submitted for independent processing	Number of hours of IWS:
Part 1		
1	<p>Subject and tasks of the course "Human Ecology". Its connection with other sciences . Basic concepts</p> <p>Draw diagrams and make a table showing various directions and subdivisions of the newest complex discipline "Human Ecology". Reflect its relationships with other scientific disciplines and fields of human activity.</p> <p><i>Literature</i> : 1, 4, 5, 14, 17.</p>	2
2	<p>The influence of physical and chemical environmental factors on human health and well-being</p> <p>Repeat the lecture material, think through and make a list of substances that have the most negative impact on health.</p> <p><i>Literature</i> : 6, 8, 9, 12, 16.</p> <p>Draw a diagram of the main routes of entry of toxic substances into the human body and the routes of removal of toxic products.</p> <p><i>Literature</i> : 6, 9, 10, 12, 15, 19.</p>	3
3	<p>Chemical pollution of the environment and its consequences</p> <p>The relationship between the chemical structure of organic and inorganic substances and their toxicity. The rule of homologous series.</p> <p><i>Literature</i> : 4, 13, 14, 18, 21.</p>	2
4	<p>Toxic effect and environmental factors. Toxicokinetics and toxicometry</p> <p>Describe what toxic metabolic products are released by different taxonomic groups of living organisms. Ecological significance of similar secondary metabolites. Toxicity receptors. Transformation of poisonous compounds in the body. The concept of lethal synthesis. Cumulation. Specific and non-specific action of toxic substances. Peculiarities of the "dose-effect" interaction. Combined and complex action of environmental pollutants. Classification of dangerousness and toxicity of substances according to toxicometric indicators.</p> <p><i>Literature</i> : 13, 14, 16, 18, 21.</p>	4
5	<p>Ecotoxicology. Violation of the state of ecosystems under the influence of man-made pollution</p> <p>Bioindication and biotesting. Determination of the toxicity of water, soil, the presence of toxic substances in the air using phyto-, zoo- and microbial tests.</p> <p><i>Literature</i> : 1, 4, 8, 11, 13, 14, 18 , 2 1.</p>	2
6	<p>Ways of determining the maximum permissible concentrations of chemical substances in the air and water of reservoirs</p> <p>Normalization of the content of chemical pollutants in reservoirs for fish farming. Ecological approaches to the establishment of MPCs.</p> <p><i>Literature</i> : 1, 5, 11, 13, 14, 21.</p>	4
7	<p>Standardization of the content of anthropogenic pollutants in soils and food products</p> <p>Population health as an indicator of the state of the environment. The problem of overpopulation and intensification of agriculture on human health. Physiological needs of the human body in food. Impact of food contamination on health. Human chemical environment and the problem of quality of food components. Enzyme systems of the body and their role in the regulation of digestive processes. The influence of assimilation of food components and regulation of the digestive process</p>	2

	from the outside: medicinal, toxic, narcotic substances. Genetically modified food components. <i>Literature</i> : 1, 3, 5, 7, 11-14, 16, 21	
8	Principles of normalization of the content of pollutants in the environment in different countries of the world. Environmental risk Environmental risk. Stages of risk determination. Differences in the regulation of harmful substances in the environment in different countries of the world. Prospects for the development of preventive and environmental toxicology. Endemic diseases. Morbidity of people in biogeochemical provinces. Antidotes. <i>Literature</i> : 1, 3, 5, 7, 11-14, 16, 21.	2
9	Territorial correlation of diseases caused by chemical, biological, radioactive, electromagnetic, noise and other types of pollution with negative changes in the surrounding environment. <i>Literature</i> : 1, 4, 8, 12, 13.	2
10	Socioecology as the newest direction of "Human Ecology". Ecology of personality and society. Biological and social nature of man <i>Literature</i> : 1, 4, 8, 12, 13.	2
Part 2		
1	Dynamics of urbanization and the state of ecology of the urban environment <i>Approaches to the study of cities: geographical, economic, sociological, engineering, general-ecological, cultural-anthropological. Capacity of the territory, demographic and ecological capacity. [6] p. 3-5.</i>	2
2	Functional zoning of city territories and environmental problems <i>Environmental problems of Ukrainian cities. [1] p. 386-402.</i>	2
3	Microclimate of the city <i>Bioclimatic methods that are based on types of weather. [3] p. 107-108.</i>	2
4	Ecological and microclimatic assessment of the city territory <i>Assessment of the impact of urban planning objects on the surrounding natural environment. [1] p. 245-249.</i>	2
5	Formation of the composition of the city's air <i>Sources of emissions of pollutants into the natural environment. [1] p. 30-35; [3] p. 96-107.</i>	2
6	Quality regulation and protection of the air environment of the city <i>Assessment of the impact of urban planning objects on the surrounding natural environment. [3] p. 107-123.</i>	2
7	Water environment of the city <i>Surface runoff from the territory of enterprises. [1] p. 35-42.</i>	2
8	Quality regulation and protection of the water environment of the city <i>Technical and technological methods of sewage treatment. [3] p. 62-74.</i>	2
9	Radiation status of the urban environment <i>Measures of premises protect from radioactive contamination . [22] p. 290-333. [1] c. 195-221; [3] c. 199-203.</i>	2
10	Protection of the city from acoustic and vibrational pollution <i>Principles of noise and vibration reduction. [6] p. 65-70.</i>	2
11	Protection of the city from electromagnetic fields and video pollution <i>Protection against electromagnetic pollution of urban population. [6] p. 71-81.</i>	2
12	Energy facilities of cities <i>Solar power, wind power, small hydropower and heat pumps. [3] p. 137-145.</i>	2
13	Urban biocenoses and the impact of pollution on their health <i>Methods of flora and fauna studying in the city. Biological rhythms and urbanization. Diseases of urbanization. [1] p. 410-414; [3] p. 227-231.</i>	2

14	Measures of vegetation protecting in urban areas <i>Basic mechanisms of adaptations of organisms and populations. Restoration and protection measures. [1] p. 340-350; [2] p. 116-170.</i>	2
15	Soil protection measures in urban areas <i>Restoration and protection measures. [1] p. 201-225.</i>	2
16	Waste and the problem of its disposal in cities <i>Solid waste landfills. [3] p. 147-155; [7] p. 80-100.</i>	2
17	Regulatory and legal framework of regulating the quality of the urban environment <i>Land cadastral information. Protection of lands of objects of cultural heritage and historical settlements [8-11].</i>	2
18	Optimization of the urban environment and resource-saving technologies <i>Using of underground space, multi-level junctions. Reconstruction of the city transport network. [3] p. 193-196</i>	2
19	Environmental protection of buildings <i>Smart home technologies. "Ecohouse" concept. [3] p. 193.</i>	2
Part 3		
20	The subject of the course "Radioecology". <i>Interrelationship of radioecology and radiobiology. [1, p . 10-37, 2, p . 19.3, p . 27].</i>	2
21	Concepts of nucleons, nuclides. <i>Prevalence of isotopes in nature. [1, p. 18-37, 2, p. 8, 3, p. 44, 9, p . 49].</i>	
22	Radioactive isotopes. <i>The impact of ionizing radiation on a person. [1, p . 18-37, 2, p . 7, 3, p . 27, 7, p . 49].</i>	4
23	Ionization. <i>Radiation monitoring of external environments [1, p . 103, 2, p. 43, 3, p . 27, 9].</i>	2
24	Dosimetry <i>Characteristics of radioactive radiation and their measurement units. [1, p . 56 , 2, p . 34, 3, p . 23, 8, p . 65].</i>	4
25	Continental, agricultural, freshwater and marine radioecology. <i>Migration of radionuclides in agrocenoses [1, 2, 3, 8, 9].</i>	4
26	<i>Preparation for MKR</i>	4
27	<i>Execution of DKR</i>	10
28	<i>Preparation for the exam</i>	3 6
	<i>Hours in general</i>	129

Policy and control

7. Policy of academic discipline (educational component)

Rules of attending of classes and behavior in classes

Students are obliged to take an active part in the educational process, not to be late for classes and not to miss them without a good reason, not to interfere with the teacher conducting classes, not to be distracted by activities unrelated to the educational process.

Rules for assigning incentive and penalty scores

- *incentive scores can be awarded by the teacher exclusively for the performance of creative works in the discipline or additional completion of online specialized courses with the receipt of the appropriate certificate:*

- ✓ https://courses.prometheus.org.ua/courses/course-v1:IRF+WST101+2019_T2/about
- ✓ <https://www.coursera.org/learn/chemicals-health>
- ✓ <https://www.coursera.org/learn/toxicology-21>
- ✓ <https://www.coursera.org/learn/evidence-based-toxicology>
- ✓ https://courses.prometheus.org.ua/courses/IRF/URBAN101/2015_T1/about
- ✓ <https://www.coursera.org/learn/qte-sustainable-cities>
- ✓ <https://www.coursera.org/learn/sharing-cities>
- ✓ <https://www.coursera.org/learn/urban-nature>

- The sum of incentive scores cannot exceed 10 % of the rating scale .
- Penalty scores within the academic discipline are provided for untimely completion and registration of laboratory work without a valid reason.

Policy of deadlines and rescheduling

In the event of arrears from the academic discipline or any force majeure circumstances, students should contact the teacher through the available (provided by the teacher) communication channels to resolve problematic issues and agree on the algorithm of actions for practice.

Policy of academic integrity

Plagiarism and other forms of dishonest work are unacceptable. Plagiarism refers to the absence of references at using printed and electronic materials, quotes, opinions of other authors. Write-offs during control work are prohibited. Inadmissible tips and write-offs during tests, classes; passing a test for another student; copying materials protected by the copyright system without the permission of the author of the work.

The policy and principles of academic integrity are defined in Chapter 3 of the Code of Honor of the National Technical University of Ukraine "Ihor Sikorsky Kyiv Polytechnic Institute". More details: <https://kpi.ua/code>

Policy of academic behavior and ethics

Students should be tolerant, respect the opinions of others, formulate objections in the correct form, constructively support feedback during classes.

Standards of ethical behavior of students and employees are defined in Chapter 2 of the Code of Honor of the National Technical University of Ukraine "Ihor Sikorskyi Kyiv Polytechnic Institute". More details: <https://kpi.ua/code>

8. Types of control and rating system for evaluating learning outcomes (RSO)

Distribution of study time by types of classes and tasks in the discipline according to the working study plan:

Semester	Training time		Distribution of study hours				Control measures		
	Credits	Acad. hours	Lectures	Practical	Lab. do	IWS	MCT	HCW	Semester control
6	8.5	255	72	18	36	129	1	1	exam

The student's rating in the discipline consists of the scores he receives for:

The student's credit module rating consists of the scores he receives for:

- 1) active participation in the work of 6 practical classes ;
- 3) performance and defense of 18 laboratory works;
- 4) execution of DKR;
- 5) execution of modular control work;
- 6) the answer to the exam.

System of rating scores and evaluation criteria

Work in practical classes:

Criteria for evaluating work in practical classes:

Completeness and signs of response	scores
"Excellent": Good preparation, active participation in the discussion of all issues and completion of assigned tasks	2
"Good": The answers do not provide a sufficient number of facts, examples, conclusions are not made, or certain inaccuracies are made	1
"Satisfactory": The student is ready to discuss only part of the questions and/or makes gross mistakes in the answers	0.5
"Unsatisfactory": Active work and preparation for practical classes are absent	0

The maximum number of scores for work in practical classes is:

2 scores \times 6 answers = 12 scores.

Performing of laboratory work:

The grade for correctly completed and completed laboratory work is 0.5 scores and takes into account the following criteria:

- the protocol of the laboratory work must contain all the necessary elements (the title page with the specified PIP and the study group, the theoretical part, the progress of the work, drawings and calculations (if it is necessary);
- each work must contain conclusions, which briefly state the purpose of the work performed and its relevance, analyze the results obtained;
- a duly completed protocol of laboratory work must be sent to the teacher within a week after its completion with using of resources of the Moodle environment indicated on the first page of the Syllabus;
- 0.5 penalty scores (-0.5 scores for each work) are charged for late completion and sending of laboratory work without a valid reason.

The maximum number of scores for performing laboratory works: 0.5 scores \times 18 works = 9 scores.

Completion and enrollment of all laboratory work is a condition for admission to the exam.

Performing homework control work:

Homework is evaluated according to the following criteria:

- "excellent" - creative approach to solving the problem - 7 scores;
- "good" - in-depth disclosure of the problem, reflected own position - 4 - 6 scores;
- "satisfactory" - justified disclosure of a problem with certain shortcomings - 1-3 scores;
- "unsatisfactory" - the task was not completed, the DKR was not credited - 0 scores.

The presence of a positive assessment on the DKR is a condition for admission to the exam.

Modular control work:

Modular control tickets consist of six tasks.

The weighted score for the answer is 4 scores. Each of the answers is evaluated separately, after which the obtained scores are summed up.

The maximum number of scores for the modular test is 4 scores \times for 6 questions = 24 scores.

Evaluation criteria for individual questions of modular test papers:

Completeness and signs of response	scores
---	---------------

"Excellent": Complete answer to the question (at least 90% of the required information) , no errors	6
"Good": The answer does not provide a sufficient number of facts, examples and conclusions (less than 75% of the required information) , individual insignificant inaccuracies are allowed , or a complete answer with minor inaccuracies	4...5
"Satisfactory": The answer is superficial (less than 60% of the required information) ; serious mistakes were made; there is no specific formulation of laws and terms	1...3
"Unsatisfactory": The question is not graded or missing	0

*Modular control work can also be conducted in the form of testing.

In total, students have to answer 48 questions related to various sections and topics of the academic discipline. The weighting score for each correct answer is 0.5 scores.

Each of the answers is evaluated separately, after which the obtained scores are summed up.

The maximum number of scores for a modular test in the form of a test is 0.5 scores \times 48 questions = 24 scores.

Thus, the maximum amount of scores of the starting component that a student can receive from the credit module "Human Ecology" is:

$$R_{c_} = 6 \times 2 + 18 \times 0.5 + 7 + 24 = 52 \text{ scores}$$

The exam component is equal to 48% of R :

$$R_{\text{exam}} = 48 \text{ scores}$$

Thus, the rating scale from the credit module "Human Ecology" is:

$$R = R_c + R_{\text{ex}} = 52 + 48 = 100 \text{ scores.}$$

According to the results of educational work in the first 7 weeks, the "ideal student" should score 6 points. At the first certification (8th week), the student receives "passed" if his current rating is at least 3 points.

According to the results of 13 weeks of study, the "ideal student" should score 20 points. At the second certification (14th week), the student receives "credited" if his current rating is at least 10 points.

A necessary condition for admission to the exam is the enrollment of all laboratory work protocols, homework control work, as well as the completion of the MCT at a sufficient level (≥ 14 points) with a total starting rating of at least 31 points.

Students who have a rating of less than 31 points at the end of the semester, as well as those who want to improve their rating, take a credit test*. At the same time, to the points they received for: performance and defense of laboratory works, performance of homework control work, points for credit control work are added and this assessment is final. The task of the control work consists of six questions related to different topics of the work program. The list of questions for the assessment test is given in Section 9 of the Syllabus. For the correct answer to each question, students receive 6 scores. Therefore, the maximum number of scores for the final test is 6 scores \times 6 = 36 scores.

The system of evaluating individual questions of the credit control work:

Completeness and signs of response	scores
"Excellent": Complete and correct answer to the question	6
"Good": The answer does not provide a sufficient number of facts, examples, conclusions are not made, or individual inaccuracies are made;	4...5

<i>"Satisfactory": A partial answer is given, the specific wording of laws and terms is missing or gross errors have been made;</i>	<i>1...3</i>
<i>"Unsatisfactory": The question is not graded or missing</i>	<i>0</i>

** Post-credit control work can also be conducted in the form of testing.*

In total, students have to answer 36 questions related to different sections and topics of the academic discipline. The weighting scores for each correct answer is 1.0 score. Each of the answers is evaluated separately, after which the obtained scores are summed up.

The maximum number of scores for writing a test is equal to 1.0 scores × 36 tasks = 36 scores.

The exam takes place in the form of an oral survey. Each exam ticket contains 6 tasks. The weighting point for a correct answer is 8 points. An approximate list of exam tasks is given in Section 9 of the Syllabus. Evaluation system of examination questions:*

<i>Completeness and signs of response</i>	<i>scores</i>
<i>"Excellent": Complete answer to the question</i>	<i>8</i>
<i>"Good": The answer does not provide a sufficient number of facts, examples and conclusions, or certain inaccuracies are made; technical errors were made during calculations</i>	<i>6...7</i>
<i>"Satisfactory": A partial answer is given, the specific wording of laws and terms is missing or serious mistakes have been made</i>	<i>1...5</i>
<i>"Unsatisfactory": The question is not graded or missing</i>	<i>0</i>

** Examination work can also be conducted remotely. At the same time, instead of theoretical questions, students perform test tasks. In total, students have to answer 48 questions related to various sections and topics of the academic discipline. The weighting point for each correct answer is 1.0 point. Each of the answers is evaluated separately, after which the obtained points are summed up.*

Thus, the maximum exam component is 48 scores.

Table of correspondence of rating score to grades on the university scale :

<i>Scores</i>	<i>Rating</i>
<i>100-95</i>	<i>Perfectly</i>
<i>94-85</i>	<i>Very good</i>
<i>84-75</i>	<i>Fine</i>
<i>74-65</i>	<i>Satisfactorily</i>
<i>64-60</i>	<i>Enough</i>
<i>Less than 60</i>	<i>Unsatisfactorily</i>
<i>Admission conditions not met</i>	<i>Not allowed</i>

9. Additional information on the discipline (educational component)

An approximate list of tasks for control and examination papers

- 1. Define the new scientific direction "Human Ecology" and formulate the concept of environmental safety. What is the connection between them?*
- 2. List the main sciences and fields of knowledge with which "Human Ecology" is connected today. To draw a conclusion about its complexity. Briefly formulate the main theses underlying the axioms of "Human Ecology".*

3. *Formulate the main questions studied by toxicology. What main directions and subdivisions of this science do you know? Describe the structure of toxicology. What distinguishes environmental toxicology from other areas of toxicology?*
4. *Describe the issues studied by industrial toxicology and its main tasks.*
5. *Determine the nature of the relationship between sanitation and hygiene. What is the field of competence of these sciences? Formulate the main range of issues on which hygiene is focused. What are its main divisions?*
6. *Define the concept of hygienic standard. List environmental factors subject to hygienic regulation.*
7. *Describe the term "homeostasis". To determine, due to which homeostasis is maintained in individual organisms and in ecological systems. What is the difference between a harmful and a harmless effect of a certain substance on a living organism?*
8. *Give a list of terms used to denote a harmful substance in modern toxicology. What are the features of using these terms?*
9. *To analyze the peculiarities of the use of the term "xenobiotic". How is belonging to this group of substances related to toxicity?*
10. *To analyze which processes and regularities are important for the development of poisoning. What type of connections are formed when poisons interact with receptors?*
11. *Give a schematic representation of the process of entry and exit of poisons from the body. Give examples of "lethal synthesis" cases. What is this phenomenon?*
12. *To characterize the relationship between the concepts of "harmful action threshold" and "adaptation voltage". How are these concepts related to the concept of homeostasis? Describe the difference between acute and chronic poisoning and the phases of poisoning.*
13. *Determine the influence of the structure of organic and inorganic substances on the toxicity and biological effect of these substances. The introduction of which functional groups can increase or decrease the toxicity of a substance? State Richardson's rule.*
14. *To characterize the toxicological content of the Meyer-Overton coefficient. Does this indicator affect the toxicity of the substance?*
15. *Compare the phenomena of cumulation and adaptation. Characterize the value of the cumulation coefficient for determining the toxicity of the substance. Give the classification of the cumulative action of substances.*
16. *Describe the procedure for establishing the threshold of harmful effects in the water of reservoirs based on the organoleptic indicator of harmfulness and on the impact on public health.*
17. *Give the algorithm of the process of standardizing the content of pollutants in the water of reservoirs used for fishing.*
18. *To determine according to what signs of harmfulness the LIMIT OF harmful substances in the water of reservoirs is established. What indicator characterizes the intensity of self-cleaning processes in water? What exceeding of the norm is considered extreme pollution of the surface waters of the land?*
19. *Give an algorithm for normalizing the content of exogenous chemical substances in soils.*
20. *To characterize the main provisions of the process of rationing the content of harmful substances in food products.*
21. *Describe the process of determining the lethal dose (concentration) and give options for its designation and measurement units.*
22. *a list of priority environmental pollutants. Explain the principle according to which substances fall into this list.*
23. *Decipher the concepts of "adaptation" and "homeostasis". Describe the main anatomical, physiological and molecular mechanisms of maintaining homeostasis. Are there certain limits (limits) of adaptation and what do they depend on?*
24. *Are there certain regularities regarding the relationship between the processes of accumulation, adaptation and removal of toxic substances from the body?*
25. *Describe the possibilities of temperature adaptation of humans and other organisms. Is there a possibility of consequences of warming or cooling of the climate on human health?*

26. Describe the impact of electromagnetic and noise pollution of the environment and their remote consequences.
27. State the main effects of ionizing radiation on living organisms. Can this factor act as a mutagenic factor?
28. What is the danger of vibration pollution of the environment?
29. Give the main classifications of chemical technogenic pollution of the environment.
30. Describe the features of distribution and accumulation of chemical pollutants in the environment and their biological effects.
31. What is the problem of disposal of household and industrial waste?
32. Is there a connection between the chemical structure of organic and inorganic substances and their toxicity. State the basic rules of such dependence.
33. State the rule of homologous series and explain its practical significance for industrial toxicology and environmental protection.
34. List the main indicators of toxicity and danger. Decipher their toxicological meaning.
35. Describe the approaches you know for creating toxicological classifications.
36. What are the shortcomings of the construction of classifications of poisonous substances and what are the ways to overcome them?
37. Does a set of environmental environmental factors affect the development of poisoning, or can it affect the resulting toxic effect?
38. What is a "species sensitivity coefficient"? Describe the algorithm of its use and practical significance.
39. Draw a diagram of the main ways of removing poisons from the body. What conclusions can be drawn after its analysis?
40. What is "cumulation" and which substances are highly cumulative? How does the cumulation factor affect the dangerousness of a substance?
41. Describe the procedure for determining the cumulation coefficient. What is the difference between material and functional accumulation?
42. In what cases and for what purpose is the stock factor used in toxicological calculations and in sanitary and hygienic regulations?
43. Define the term MPC and describe its meaning as a parameter of toxicometry and as a legal basis for sanitary control.
44. Describe the possibilities and ways of self-purification of ecosystems from harmful pollutants.
45. Describe the current state of the biosphere and the concentration levels of ecotoxicants in the environment.
46. Describe the consequences of the joint action of harmful substances on living organisms.
47. How does the bioindication procedure differ from biotesting? Describe the advantages and disadvantages of using similar approaches to assess environmental quality.
48. What features should a bioindicator species have?
49. Describe the ways of determining MPC in the air of the working area and in atmospheric air.
50. What signs of harmfulness are established when regulating the water quality of reservoirs?
51. What are the peculiarities of setting the MPC of substances in reservoirs for fish farming purposes?
52. What are the signs of harmfulness used to determine the MPC of harmful substances in soils?
53. How to standardize the content of pollutants for a specific type of soil?
54. List the most dangerous groups of toxicants that can be found in food products.
55. What is "environmental risk" and through what indicators can it be determined?
56. Give a list of known antidotes and examples of their use in poisoning.
57. Decipher the concept of "biogeochemical provinces" and describe endemic diseases known to you, as well as methods of combating them.
58. List the main aims and objectives of environmental toxicology.
59. Describe the procedure for establishing the toxicity class of waste.
60. Give a list of the main toxicometric indicators, depict their graphic relationship. Explain patterns
61. To characterize the principles on the basis of which priority is determined in the selection of compounds for toxicological assessment according to the standards of the World Health Organization (WHO).

62. Calculate and analyze whether the threshold of harmful effects due to the influence of pollutants on the sanitary regime of the water body has been exceeded, if the titration of samples of natural and polluted water with a solution of sodium thiosulfate with determined oxygen by the Winkler method gave the specified results. What is the name of the indicator that is calculated based on the analysis of changes in the oxygen content in a water sample? What processes in the water body indicate such changes?
63. Determine the value of the biochemical indicator (BP) and evaluate the ability of wastewater to be subjected to biological oxidation, if the CSC value for a given water sample is a certain amount of mg/l O₂, and as a result of determining the BSC total, the specified results were obtained. Calculate the required wastewater dilution rate for calculations yourself.
64. State the principles of normalization of permissible anthropogenic load on the environment provided for by the Law on Environmental Protection?
65. Describe the climatic parameters and regimes taken into account when planning and building urban settlements, designing buildings and structures?
66. Name the factors of the natural environment that affect the microclimatic conditions of the area?
67. Name the factors of the urban environment that affect the formation of the microclimate of the city?
68. Specify the microclimatic variability of general climatic regimes in certain areas of the territory of a large city.
69. Specify bioclimatic indicators of weather conditions.
70. Name the methods used to assess the city's bioclimate?
71. Describe what meteorological factors determine the dispersion of impurities and aerosols in the air?
72. Explain what is the essence of the concept "Atmospheric pollution potential"?
73. What are the environmental criteria for assessing the city's microclimate?
74. Describe the ecological and microclimatic zoning of the city territory.
75. Specify the main composition of engineering studies for construction as sources of information about natural and man-made conditions and the ecological state of the built-up area?
76. Give the methods used for comprehensive assessment of the impact of natural and anthropogenic factors on the urban environment?
77. Explain what climatic and natural and man-made factors are taken into account when developing urban planning and project documentation for regulation, protection and environmental safety of the urban environment?
78. Give the classification of pollutants and sources of pollution of the urban environment.
79. Give examples of methods of protecting the environment of buildings from internal and external vibration.
80. Specify measures to protect the indoor environment from electromagnetic fields.
81. Explain the reasons for the radiation pollution of buildings?
82. State the radiation hygiene requirements at the stages of building construction and operation.
83. Give the factors that determine the quality of the living environment at the urban planning level and at the scale of an individual building?
84. Write down the equation that represents the law of radioactive decay?
85. What types of doses do you know?
86. Describe the general features of the biological effect of radiation?
87. What sources belong to artificial sources of ionizing radiation?
88. Name the main sources of increase in the content of natural radionuclides in the environment?
89. In what ways is a person exposed to radiation?
90. Name the ways of accumulation of radionuclides by the body.
91. What are the main methods of radiation protection?
92. Describe dosimetric and radiometric devices.
93. In what ways do radionuclides enter terrestrial ecosystems?
94. Schematically depict the process of radiolysis of water.
95. What happens when ionizing radiation passes through matter?
96. What is a radiation dose?

97. What does the radiosensitivity of plant phytocenoses depend on?
98. Describe the four degrees of radiation sickness.
99. Name the ways of incorporating radionuclides into biological cycles.
100. What are the types of radionuclides entering the vegetation?
101. What does the radiocapacity of ecosystems mean?
102. What are the principles of radiation safety based on NRBU-97?
103. Name the main dose limits of exposure and permissible levels.
104. Give the classification of radiation control devices?
105. Give general recommendations to the population with an increased radiation background.
106. Name the main areas of the environmental program of UNEP.
107. What functions do microorganisms perform in relation to radionuclides?
108. What does the migration ability of radionuclides depend on?
109. Describe the migration of radionuclides in freshwater ecosystems.
110. What does RMAPK mean?
111. Describe the algorithm of radio-ecological examination of a nuclear enterprise.
112. What are radioactive wastes according to their state of aggregation?
113. What are radio protectors?
114. What is World Health Organization?
115. Depending on the number of protons and neutrons, what types of nuclei are divided into?

Approximate tasks submitted to the HCW

1. Calculate the demographic capacity of the territory.
Determine the factors that limit the demographic capacity of the territory to the greatest extent, propose measures to increase it.
Calculate the reproductive capacity of the territory in terms of oxygen.
Make a conclusion about the sufficiency of the reproductive capacity of the territory in terms of oxygen.
2. Calculate the air pollution index (AIP) in the city and the integrated air pollution index (IAP). Estimate the level of air pollution in the city.
3. Calculate the flow of water coming from various natural and man-made sources, as well as the content of pollutants in them.
4. Calculate the area of the solid household waste landfill and the volume released during the decomposition of biogas waste as a whole and by components.
5. To determine the degree of danger of urban soil pollution, to establish which pollutants contribute the most to the total pollution index. To characterize the detected geochemical anomalies, establishing which pollutants pose the greatest danger to ecosystems and human health. Field observation data are presented in tables.
6. Develop an assortment of sustainable plants and prepare proposals for landscaping various functional areas of the city.

Working program of the academic discipline (syllabus):

Compiled by associate professor, Ph.D.. Vember V.V., associate professor, Ph.D. Nosachova Yu.V., associate professor, Ph.D. Ovsyankina V.O.

Approved by the department E and TRP (protocol No. 14 dated 06/08/2022)

Agreed by the IHF Methodical Commission (protocol No. 10 dated 06/24/2022)