National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"

Ecology and Technology of Plant Polymers

URBOECOLOGY

Work program of the discipline (Syllabus)

Details of the discipline	
Level of higher education	***First (Bachelor's)***
Field of knowledge	*16 Chemical Engineering and Bioengineering*
Speciality	*161 Chemical Technology and Engineering*
Educational program	*Industrial Ecology and Resource-Efficient Cleaner Technologies*
Discipline status	*Optional educational components*
Form of study	*Correspondence*
Year of preparation, semester	*3rd year, autumn semester*
Scope of discipline	*4 (120)*
Semester control / control measures	*final test*
Timetable	
Language of instruction	*Ukrainian*
Information about Course Leader / Instructors	Lector: *https://eco-paper.kpi.ua/pro-kafedru/vykladachi/nosachova-yuliya-viktorivna.html*
Course Placement	*https://do.ipo.kpi.ua/course/view.php?id=2153*

The program of the discipline

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

The academic discipline "Urban Ecology" is one of the disciplines of urban planning science and human ecology, which studies the interaction of the city, its population with the environment that surrounds it. The city, as an unbalanced geoecosystem, is under the constant influence of engineering, transport and social infrastructure, which leads to a violation of the ability to self-restore the natural environment. The discipline is devoted to the consideration of systems that determine and ensure sustainable development of the quality of life of the urban population. Mainly, city systems are related to communal services and generally turn the urban environment into a super-geoecosystem.

"Urban Ecology" contributes to the formation of an ecological worldview regarding the unity and close relationship between the components of natural systems and the functioning of engineering systems of the city. A future ecologist must know the principles of operation of the components of urban systems and be able to make organizational, regulatory, environmental and other decisions that ensure the environmentally safe functioning of the urban engineering and technical infrastructure.

***The subject of the discipline is** the city, urbanization, urbanized environment, functions of cities, urbanized landscapes, factors of the urbanized environment, biological adaptation, ecological energy, vegetation, animal population, urbanized biotopes, biological damage, landscape engineering of the urbanized environment, protected areas in cities.*

To a large extent, the solution of this problem will be determined by the level of training of specialists working in the field of environmental protection, including institutions of environmental safety management of the state, scientific institutions and organizations, enterprises.

To successfully solve the problems of protection and conservation of natural aquatic ecosystems, specialists must be fluent in information, be able to solve complex problems of environmental protection in cities from pollution at the highest scientific level.

The purpose of the discipline "Urban Ecology"

The purpose of studying the discipline "Urban Ecology" is to form students' complex of knowledge, skills, and abilities necessary for qualified management of environmental activities at the level of industrial enterprises, institutions, organizations, at the level of units of the Ministry of Environmental Safety of Ukraine.

In accordance with the purpose, the training of bachelors in this specialty requires strengthening the competencies formed by students:

- ability to use the theoretical foundations of ecology, environmental protection and sustainable use of natural resources, basic principles and components of environmental management.

The main tasks of the discipline

After mastering the discipline "Urban Ecology", the following learning outcomes should be demonstrated:

- participate in the development and implementation of projects aimed at optimal management and management of industrial waste;

- Understand the basic environmental laws, rules and principles of environmental protection and nature management.

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

*The study of the discipline **"Urban Ecology"** is directly based on at least the following disciplines belonging to the structural and logical scheme of bachelor's training: "Industrial Ecology", "General and Inorganic Chemistry". The acquired knowledge and skills are used in the study of the following disciplines: "Toxicology", "Waste Disposal and Recuperation" and others.*

2. The content of the discipline

Chapter 1. Concepts and Principles of Urban Ecology.

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

The city as an artificial habitat. Features of urban systems compared to settlements of other types. Urban agglomerations. Large industrial centers. Global dynamics of urbanization. Natural, technogenic, socio-economic and socio-demographic subsystems. Flows of energy, matter and information through the urban sociogeosystem. Approaches to the study of cities: geographical, economic, sociological, engineering, general ecological, cultural and anthropological. Territory capacity, demographic and ecological capacity.

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

Residential, landscape and recreational, industrial. Three Models of Spatial Urban Structure. Natural, economic, socio-psychological factors influencing the location of urban settlements. Motorization, spatial organization of territories, natural and man-made hazards. Ways of sustainable development of the urban environment. Assessment of the city's development: point, sustainable development index. Environmental problems of Ukrainian cities.

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

Topic 1: Microclimate of the city.

Bioclimatic conditions of the city (insolation, thermal, 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), the method of heat balance.

Topic 2: Ecological and microclimatic assessment of the city.

Method of integral ecological and microclimatic zoning of the city territories. Integral ecological map of the city. Environmental passport of the city. Influence of environmental factors on urban development planning. Assessment of the impact of urban planning objects on the environment.

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

Standardization of atmospheric air quality. Comprehensive indicators and assessment of the state of the city's air environment. Sources of emissions of pollutants into the environment.

Topic 4: Regulation of quality and protection of the air environment of the city.

Determination of the size of the sanitary protection zone. Methods of urban air protection: urban planning, administrative-organizational, techno-technological, regulatory and legal. Assessment of the impact of urban planning objects on the environment.

Topic 5: Aquatic environment of the city.

Indicators and assessment of the quality of natural waters. Sanitary and hygienic rationing. Water Pollution Index. Surface runoff from the territory of enterprises.

Topic 6: Regulation of quality and protection of the city's water environment.

Technical and technological methods of drinking water treatment. Town-planning methods of protection of waters for economic and drinking purposes. Sanitary protection zones. Wastewater of the city. Technical and technological methods of wastewater treatment.

Chapter 3. Energy pollution of the urban environment.

Topic 1: Radiation state of the urban environment.

Characteristics of radionuclides and radiation doses. Radiation background and radioactivity of the environment of buildings. Measures to protect the premises from radioactive contamination.

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

Noise and vibration pollution. Parameters and classification. Sources of education. Effects of acoustic pollution on humans. Principles of noise and vibration reduction.

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

Sources and extent of electromagnetic pollution. Sanitary Rationing, Role and Biological Effect of Electromagnetic Fields. Protection against electromagnetic pollution of the population of cities.

Topic 4: Energy facilities of cities.

Structure and trends in the development of energy supply. Small-scale power generation facilities. Impact of energy facilities on the environment. Solar power, wind power, small hydropower and heat pumps.

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

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

Urbanized biotopes. Structure and dynamics of urban populations. Microbiotopes. Hemericity of biotopes. Stages of formation of flora and fauna in urbanized areas. Reactions of organisms to the peculiarity of the conditions of the urbanized environment. Effects of pollution on human health. Methods of research of flora and fauna in the city. Biological rhythms and urbanization. Diseases of urbanization.

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

Degradation and ecological function of vegetation cover in urban areas. Indicators and assessment of the ecological state of vegetation cover in urban areas. Basic mechanisms of adaptation of organisms and populations. Restoration and protection measures.

Topic 3: Soil conservation measures in urban areas.

Degradation and ecological function of urban soils. Indicators and assessment of the ecological state of urban soils. Man-made polluted areas. Restoration and protection measures.

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

Industrial and household waste. Norms for the accumulation of solid household waste (MSW). Morphological composition, sanitary and bacteriological properties of solid waste. Collection and transportation. Technical and technological methods of processing. Disposal problems. Landfills.

Chapter 5. Regulatory and Legal Aspects of Optimization and Protection of the Urban Environment.

Topic 1: Regulatory framework for regulating the quality of the urban environment.

Sources of the environmental regulatory framework: the Constitution, laws in the field of nature management and environmental protection, presidential decrees and orders and government resolutions; normative acts of ministries and departments; normative decisions of local self-government bodies. Assessment of the quality of urban land. Land cadastral information. Protection of lands, cultural heritage sites and historical settlements.

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

Planning measures for industrial zones, residential areas, public complexes and places of mass recreation. Hygienic justification of the optimal density of settlement and building. Monitoring of the urban environment. Use of underground space, multi-level interchanges. Reconstruction of the urban transport network. Ecocity.

Topic 3: Protection of the environment of buildings.

Meteorological indicators of the microclimate of the premises. Regulation of indoor air quality. Protection against harmful volatile substances, asbestos fibers that are part of building and finishing materials. Norms and methods of noise and vibration protection of premises. Ecology of the living environment. Smart Home Technologies. The concept of "Eco-house".

3. Training Materials & Resources

Basic

1. Urban Ecology: Textbook for Students of Higher Educational Institutions / V.P. Kucheryavyi – Lviv, Publishing House "Novyi Svit-2000", 2021. – 460 p.

2. Urboecology and phytomelioration: textbook / L.M. Filipova, A.P. Stadnyk, V.V. Matskevich and others. – Bila Tserkva, 2018. – 214 p.

3. Urboecology / I. A. Vasylenko, O. A. Pivovarov, I. M. Trus, A. V. Ivanchenko. Dnipro: Accent PP, 2017. 309 p. (in Russian).

Secondary

4. Urboecology: educational and methodological manual / O. M. Klymchyk; Ministry of Education and Science of Ukraine, Zhytomyr National Agroecological University. – Kherson: OLDI-plus, 2019. – 208 p. – Refs. pp. 203-206.

5. Reclamation properties of park plantations in the conditions of complex relief: monograph / V. V. Minder, V. M. Malyuga, V. Yu. for Science. Ed. V. Y. Yukhnovsky. Kyiv: Kondor, 2019. - 224,[4] p. : ill., table. -Refs. pp. 196-224

6. Law of Ukraine "On the Improvement of Settlements" dated 06.09.2005 No. 2807-IV // VVRU — 2005 — No. 49 — Art. 527.

7. Law of Ukraine "On the General Scheme of Planning of the Territory of Ukraine" dated 7.02.2002, No. 3059-III // VVRU — 2002 — No. 30 — Art. 204.

8. Law of Ukraine "On the Fundamentals of Urban Planning" dated 16.11.1992 No. 2780-XII // VVRU — 1992 — No. 52 — Art. 683.

9. Methodical instructions for independent work on the discipline "Urban Ecology" for bachelors with the direction of training 6.040106 "Ecology, environmental protection and balanced nature management"/ Ukl.: O.M.Gorokhovskyi. – K.: NTUU "KPI", 2012. –47 p. (in Russian).

Educational content

5. Methods of mastering the discipline (educational component)

Lectures

Lectures are aimed at:

- *providing up-to-date, holistic, interdependent knowledge in the discipline "Human Ecology", the level of which is determined by the target setting for each specific topic;*
- *ensuring the 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;*
- *formation of students' necessary interest and providing direction for independent work;*
- *determination at the current level of development of science and technology in the field of environmental protection, forecasting their development for the coming years;*
- *reflection of methodical processing of the material (highlighting the main provisions, conclusions, recommendations, clear and adequate formulations of them);*
- *use of visual materials for demonstration, combination, if possible, with demonstration of results and samples;*

teaching research materials in a clear and high-quality language in compliance with structural and logical connections, explanation of all newly introduced terms and concepts; accessibility for perception by this audience.Salary No.	***Title of the topic of the lecture and a list of the main questions (list of didactic aids, references to literature and tasks for the SRS)***	***Hours***
	Chapter 1. Concepts and Principles of Urban Ecology	
1	***Topic 1. Dynamics of urbanization and ecological state of the urban environment*** *The city as an artificial habitat. Features of urban systems compared to settlements of other types. Urban agglomerations. Large industrial centers. Global dynamics of urbanization. Natural, technogenic, socio-economic and socio-demographic subsystems. Flows of energy, matter and information through the urban sociogeosystem.* ***References: [****1] pp. 5-12; [3] p. 9-23; [6] p. 11-37.* ***Tasks for the SRS:*** *Approaches to the study of cities: geographical, economic, sociological, engineering, general ecological, cultural and anthropological. [6] p. 1-11.*	***0,5***
2	***Topic 2. Functional zoning of the city's territories and environmental problems*** *Residential, landscape and recreational, industrial. Three Models of Spatial Urban Structure. Natural, economic, socio-psychological factors influencing the location of urban settlements. Motorization, spatial organization of territories, natural and man-made hazards. Ways of sustainable development of the urban environment.* ***References:*** *[1] pp. 12-22; [3] p. 23-25; [6] p. 309-315* ***Tasks for the SRS:*** *Environmental problems of Ukrainian cities. [1] p. 30-49; [6] p. 37-47*	*0,5*

Chapter 2. Ecological and Climatic Aspects and Moving Environments of Urbanized Areas		
3	***Topic 1. Microclimate of the city*** *Bioclimatic conditions of the city (insolation, thermal, 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), the method of heat balance.* ***References:** [1] pp. 232-240; [3] p. 107-108.* ***Tasks for the CPC:** Bioclimatic methods based on weather types. [1] p. 245-249.*	*0,5*
4	***Topic 2. Ecological and microclimatic assessment of the city territory*** *Method of integral ecological and microclimatic zoning of the city territories. Integral ecological map of the city. Environmental passport of the city. Influence of environmental factors on urban development planning.* ***References:** [1] pp. 390-402; [3] p. 261-265, [8-11]* ***Task for the SRS:** Assessment of the impact of urban planning objects on the environment. [7] p. 25-48.*	***0,5***
5	***Topic 3. Formation of the composition of the city's air*** *Standardization of atmospheric air quality. Comprehensive indicators and assessment of the state of the city's air environment.* ***References:** [1] pp. 30-35; [3] p. 96-123; [6] p. 111-117.* ***Objectives for the CPC:** Sources of emissions of pollutants into the environment. [1] p. 249-268.*	***0,5***
6	***Topic 4. Regulation of quality and protection of the air environment of the city*** *Determination of the size of the sanitary protection zone. Methods of urban air protection: urban planning, administrative-organizational, techno-technological, regulatory and legal.* ***References:** [2] pp. 116-131 ; [6] p. 107-111.* ***Task for the SRS:** Assessment of the impact of urban planning objects on the environment. [3] p. 231-233*	***0,5***
7	***Topic 5. Aquatic environment of the city*** *Indicators and assessment of the quality of natural waters. Sanitary and hygienic rationing. Water Pollution Index.* ***References:** [1] pp. 35-42; [6] p. 100-107**.*** ***Tasks for the CPC:** Surface runoff from the territory of enterprises. [2] p. 22-32.*	***0,5***
8	***Topic 6. Quality regulation and protection of the city's water environment*** *Technical and technological methods of drinking water treatment. Town-planning methods of protection of waters for economic and drinking purposes. Sanitary protection zones. Wastewater of the city.* ***References:** [3] p. 60-93, [7] p. 41-46.* ***Tasks for the SRS:** Technical and technological methods of wastewater treatment. [3] p. 69-74.*	***0,5***
Chapter 3. Energy pollution of the urban environment		

9	***Topic 1. Radiation state of the urban environment*** *Characteristics of radionuclides and radiation doses. Radiation background and radioactivity of the environment of buildings.* ***References:*** *[1] pp. 47-49; [6] pp.63-65.* ***Tasks for the SRS:*** *Measures to protect the premises from radioactive contamination. [6] p. 65-70.*	***0,5***
10	***Topic 2. Protection of the city from acoustic and vibration pollution*** *Noise and vibration pollution. Parameters and classification. Sources of education. Sound map of the city. Effects of acoustic pollution on humans.* ***References:*** *[1] pp. 47-49; [3] p. 108-117* ***CPC Task:*** *Principles of Noise and Vibration Reduction. [3] p. 239-241.*	***0,5***
11	***Topic 3. Protection of the city from electromagnetic fields and video pollution*** *Sources and scale of electromagnetic and light pollution. Sanitary Rationing, Role and Biological Effect of Electromagnetic Fields.* ***References****: [3] pp. 108-117* ***Tasks for the SRS:*** *Protection of the population of cities from electromagnetic pollution. [4] p. 54-58.*	***0,5***
12	***Topic 4. Energy facilities of cities*** *Structure and trends in the development of energy supply. Small-scale power generation facilities. Impact of energy facilities on the environment.* ***References:*** *[3] p. 124-145, [6] p. 225-231.* ***Tasks for the CPC:*** *Solar energy, wind energy. [3] p. 137-145.*	***0,5***
Chapter 4. Biocenoses, soils and waste management in urbanized areas		
13	***Topic 1. Urban biocenoses and the impact of pollution on their health*** *Urbanized biotopes. Structure and dynamics of urban populations. Microbiotopes. Hemericity of biotopes. Stages of formation of flora and fauna in urbanized areas. Reactions of organisms to the peculiarity of the conditions of the urbanized environment. Effects of pollution on human health.* ***References:*** *[1] pp. 170-191; [3] p. 221-231; [6] p. 295-321.* ***Tasks for the SRS:*** *Methods of research of flora and fauna in the city. Biological rhythms and urbanization. Diseases of urbanization. [1] p. 331-355; [3] p. 221-227.*	***0,5***
14	***Topic 2. Measures for the protection of vegetation cover in urban areas*** *Degradation and ecological function of vegetation cover in urban areas. Indicators and assessment of the ecological state of vegetation cover in urban areas.* ***References:*** *[1] pp. 236-253; [3] p. 205-209.* ***Tasks for the SRS:*** *Basic mechanisms of adaptation of organisms and populations. [1] p. 312-319, 299-300.*	***0,25***

15	***Topic 3. Soil protection measures in urban areas*** *Degradation and ecological function of urban soils. Indicators and assessment of the ecological state of urban soils. Man-made polluted areas.* ***References:*** *[1] pp. 201-245; [6] p. 93-100.* ***Tasks for the SRS:*** *Recovery and protection measures. [6] p. 269-287.*	***0,5***
16	***Topic 4. Waste and the problem of its disposal in cities*** *Industrial and household waste. Norms for the accumulation of solid household waste (MSW). Morphological composition, sanitary and bacteriological properties of solid waste. Collection and transportation. Technical and technological methods of processing. Disposal problems.* ***References:*** *[3] p. 146-164* ***Tasks for SRS:*** *Landfills. [3] p. 156-159.*	***0,5***
Chapter 5. Regulatory and Legal Aspects of Optimization and Protection of the Urban Environment		
17	***Topic 1. Regulatory framework for regulating the quality of the urban environment*** *Sources of the environmental regulatory framework: the Constitution, laws in the field of nature management and environmental protection, presidential decrees and orders and government resolutions; normative acts of ministries and departments; normative decisions of local self-government bodies. Assessment of the quality of urban land.* ***References:*** *[8-11].* *Tasks for the SRS: Land cadastral information. Protection of lands, cultural heritage sites and historical settlements [8-11].*	***0,5***
18	***Topic 2. Optimization of the urban environment and resource-saving technologies*** *Planning measures for industrial zones, residential areas, public complexes and places of mass recreation. Hygienic justification of the optimal density of settlement and building. Monitoring of the urban environment.* ***References:*** *[1] p. 329-355; [3] p. 209-213.* ***Tasks for the SRS:*** *Use of underground space, multi-level interchanges. Reconstruction of the urban transport network. [3] p. 193-196*	***0,25***
19	***Topic 3. Protection of the environment of buildings*** *Meteorological indicators of the microclimate of the premises. Regulation of indoor air quality. Protection against harmful volatile substances, asbestos fibers that are part of building and finishing materials. Norms and methods of noise and vibration protection of premises. Ecology of the living environment.* ***References:*** *[3] pp. 181-193; [7]* ***Tasks for the CPC:*** *Smart Home technologies. The concept of "Eco-house". [3] p. 193.*	***0,25***
	Just	***8***

Practical classes

In the system of professional training of students in this discipline, practical classes occupy 55.6% of the classroom load. As an addition to the lecture course, they lay and form the basis for the qualification of bachelors in the field of ecology, namely the protection of urban emergencies from anthropogenic impact. The content of these classes and the methods of their conduct should ensure the development of the creative activity of the individual. They develop scientific thinking and the ability to use special terminology, allow you to test knowledge, so this type of work is an important means of operational feedback. Practical classes should perform not only cognitive and educational functions, but also contribute to the growth of students as creative workers in the field of environmental protection.

The main tasks of the cycle of practical classes:

- *to help students systematize, consolidate and deepen theoretical knowledge in the field of modern principles of the formation of urban ecosystems;*
- *to teach students the techniques of solving practical problems, to promote the mastery of skills and abilities to perform calculations, graphic and other tasks;*
- *teach them to work with scientific and reference literature and regulatory documents;*
- *to form the ability to learn independently, that is, to master the methods, ways and techniques of self-study, self-development and self-control.*

Salary No.	***Title of the topic of the practical lesson and a list of the main questions (list of didactic support, links to literature and tasks for the SRS)***	***Hours***
1	*Topic 1. Ecological equilibrium of the urbanized area, calculation of indicators of the demographic capacity of the territory [3]. Assessment of bioclimatic conditions of the city [3].* *Tasks for the CPS: Territory capacity, demographic and environmental capacity. Assessment of the city's development: point, sustainable development index. [3] p. 247-251. Bioclimatic methods that are based on weather types. Assessment of the impact of urban planning objects on the environment. [3] p. 261-262; [12].*	***3***
2	***Topic 2. Methods for assessing the impact of enterprises, road transport and roads on the quality of atmospheric air in the city. Measurement of the main indicators of water quality 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. Measuring, analysing and forecasting acoustic pollution of urban areas.*** *[3] pp. 238-239* ***Objectives for the CPC: Sources of emissions of pollutants into the environment.*** *Assessment of the impact of urban planning objects on the environment. [3] p. 233-235. Surface runoff from the territory of enterprises. Technical and technological methods of wastewater treatment. [2] p. 32-38. Measures to protect premises from radioactive contamination. Principles of noise and vibration reduction. [3] p. 239-241.*	***3***
3	***Writing MKR***	***2***
4	*Topic 3. Engineering-protective and architectural-planning phytomelioration. Sanitary and hygienic assessment of green plants in settlements. Bioindication as an approach to environmental assessment.* *Tasks for the SRS: Protection of the population of cities from electromagnetic pollution. [1] p. 340-350, [2] p. 116-170.*	*2*
	Just	***10***

6. Student's independent work

Independent work takes 85% of the time of studying the credit module, including preparation for the test. The main task of students' independent work is the acquisition of scientific knowledge in areas that are not included in the list of lecture questions through personal search for information, the formation of an active interest in a creative approach in educational work. In the process of independent work within the educational component, the student must learn to deeply analyze modern approaches to the development and implementation of the latest approaches to the formation and maintenance of dynamic ecological balance in the context of global urbanization.

Salary No.	Name of the topic to be submitted for self-study	Number of CPC hours
	Chapter 1. Concepts and Principles of Urban Ecology	
1	*Topic 1. Dynamics of urbanization and the state of ecology of the urban environment* *Approaches to the study of cities: geographical, economic, sociological, engineering, general ecological, cultural and anthropological. Territory capacity, demographic and ecological capacity. [6] p. 3-5.*	4
2	*Topic 2. Functional zoning of the city's territories and environmental problems* *Environmental problems of Ukrainian cities. [1] p. 386-402.*	4
	Chapter 2. Ecological and Climatic Aspects and Moving Environments of Urbanized Areas	
3	*Topic 1. Microclimate of the city* *Bioclimatic methods that are based on weather types. [3] p. 107-108.*	4
4	*Topic 2. Ecological and microclimatic assessment of the city territory* *Assessment of the impact of urban planning objects on the environment. [1] p. 245-249.*	4
5	*Topic 3. Formation of the composition of the city's air* *Sources of emissions of pollutants into the environment. [1] p. 30-35; [3] p. 96-107.*	4
6	*Topic 4. Regulation of quality and protection of the air environment of the city* *Assessment of the impact of urban planning objects on the environment. [3] p. 107-123.*	4
7	*Topic 5. Aquatic environment of the city* *Surface runoff from the territory of enterprises. [1] p. 35-42.*	4
8	*Topic 6. Quality regulation and protection of the city's water environment* *Technical and technological methods of wastewater treatment. [3] p. 62-74.*	5
	Chapter 3. Energy pollution of the urban environment	
9	*Topic 1. Radiation state of the urban environment* *Measures to protect the premises from radioactive contamination. [6] p. 65-70.*	4
10	*Topic 2. Protection of the city from acoustic and vibration pollution* *Principles of noise and vibration reduction. [6] p. 65-70.*	4
11	*Topic 3. Protection of the city from electromagnetic fields and video pollution* *Protection against electromagnetic pollution of the population of cities. [6] p. 71-81.*	4
12	*Topic 4. Energy facilities of cities* *Solar power, wind power, small hydropower and heat pumps. [3] p. 137-145.*	5

Chapter 4. Biocenoses, soils and waste management in urbanized areas		
13	*Topic 1. Urban biocenoses and the impact of pollution on their health* *Methods of research of flora and fauna in the city. Biological rhythms and urbanization. Diseases of urbanization. [1] p. 410-414; [3] p. 227-231.*	*4*
14	*Topic 2. Measures for the protection of vegetation cover in urban areas* *Basic mechanisms of adaptation of organisms and populations. Restoration and protection measures. [1] p. 340-350; [2] p. 116-170.*	*4*
15	*Topic 3. Soil protection measures in urban areas* *Restoration and protection measures. [1] p. 201-225.*	*5*
16	*Topic 4. Waste and the problem of its disposal in cities* *Landfills. [3] p. 147-155; [7] p. 80-100.*	*4*
Chapter 5. Regulatory and Legal Aspects of Optimization and Protection of the Urban Environment		
17	*Topic 1. Regulatory framework for regulating the quality of the urban environment* *Land cadastral information. Protection of lands, cultural heritage sites and historical settlements [8-11].*	*4*
18	*Topic 2. Optimization of the urban environment and resource-saving technologies* *Use of underground space, multi-level interchanges. Reconstruction of the urban transport network. [3] p. 193-196*	*5*
19	*Topic 3. Protection of the environment of buildings* *Smart Home Technologies. The concept of "Eco-house". [3] p. 193.*	*4*
20	*Preparation for the ICR*	*6*
21	*Implementation of R&D*	*10*
22	*Exam Preparation*	*6*
	Total Hours	*102*

Provision of program results by the components of the educational component

Name of PR	***Lectures***	***Practical & Laboratory Lessons, individual task***

Understand the basic environmental laws, rules and principles of environmental protection and nature management	*Dynamics of urbanization and ecological state of the urban environment* *Urban biocenoses and the impact of pollution on their health* *Functional zoning of the city territories and environmental problems.* *Ecological and microclimatic assessment of the city territory* *Formation of the composition of the city's air* *Aquatic environment of the city* *Regulatory framework for regulating the quality of the urban environment* *Regulation of quality and protection of the air environment of the city* *Quality regulation and protection of the city's water environment* *Protection of the city from acoustic and vibration pollution* *Protection of the city from electromagnetic fields and video pollution* *Measures for the protection of vegetation cover in urban areas* *Soil protection measures in urban areas* *Protection of the environment of buildings* *Radiation state of the urban environment* *Energy facilities of cities* *Optimization of the urban environment and resource-saving technologies*	*Ecological balance of the urbanized area, calculation of indicators of the demographic capacity of the territory. Assessment of bioclimatic conditions of the city.* *Methods for assessing the impact of enterprises, road transport and roads on the quality of atmospheric air in the city. Measurement of the main indicators of water quality, water supply sources of the city and their comparative analysis. Calculation of the total volume of surface runoff and annual removal of pollutants from the urban area. Measuring, analysing and forecasting acoustic pollution of urban areas.* *Engineering-protective and architectural-planning phytomelioration. Sanitary and hygienic assessment of green plants in settlements.* *Bioindication as an approach to environmental assessment.*
Participate in the development and implementation of projects aimed at optimal management and management of industrial and municipal waste	*Waste and the problem of its disposal in cities*	

Policy & Control

7. Academic discipline policy (educational component)

Rules for attending classes and behavior in the classroom

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 valid reason, not to interfere with the teacher's classes, not to be distracted by actions that are not related to the educational process.

Rules for assigning incentive and penalty points

- *Incentive points can be awarded by the teacher only for the performance of creative work on the discipline or additional completion of online profile courses with the receipt of the appropriate certificate:*
- *https://courses.prometheus.org.ua/courses/course-v1:IRF+WST101+2019_T2/about. Course "Household Waste Action Now"*
- *https://www.coursera.org/learn/sustainable-transportation-networks-and-streetscapes. Sustainable Transportation Networks and Streetscapes*
- *https://www.coursera.org/learn/iglus Innovative Governance of Large Urban Systems*
- *https://www.coursera.org/learn/sharing-cities Sharing Cities: Governance and Urban Sustainability*
- *https://www.coursera.org/learn/urban-nature Urban Nature: Connecting Cities, Nature and Innovation.*

But their amount cannot exceed 10% of the rating scale.

- *There are no penalty points within the academic discipline.*

Deadlines and retakes policy

In case of arrears in academic discipline or any force majeure, students must contact the teacher through the available (provided by the teacher) communication channels to resolve problematic issues and agree on an algorithm of actions for working out.

Academic Integrity Policy

Plagiarism and other forms of dishonest work are unacceptable. Plagiarism includes the lack of references when using printed and electronic materials, quotes, opinions of other authors. Inadmissible hints and cheating when writing tests, conducting classes; passing a test for another graduate student; copying copyrighted material without the permission of the author of the work.

The policy and principles of academic integrity are defined in Section 3 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". Read more: https://kpi.ua/code

Academic Conduct and Ethics Policy

Students should be tolerant, respect the opinion of others, formulate objections in the correct form, and constructively maintain feedback in the classroom.

The norms of ethical behavior of students and employees are defined in Section 2 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". Read more: https://kpi.ua/code

8. Types of control and rating system for assessing learning outcomes (CRO)

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

Semester	*Study time*		*Distribution of study hours*				*Control measures*		
	Loans	*Acad. Sci. H.*	*Lecture*	*Practical*	*Lab. Rob.*	*SRS*	*FDM*	*OCD*	*Semester control*
5	*4*	*120*	*8*	*10*	*–*	*102*	*1*	*1*	*Passed*

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

The student's rating in the credit module is calculated from 100 points, of which 52 points are the starting scale.

The starting rating (during the semester) consists of the points that the student receives for:

– work in practical classes (5 lessons);

– performance of modular control work;

– homework.

System of rating (weight) points and evaluation criteria
Criteria for awarding points:
***Work in practical classes**:*
– active creative work – 2 points;
– fruitful work – 1 point;
– absence from class without valid reasons – -1 point.
"unsatisfactory" – the answer does not meet the requirements for "satisfactory" – 0 points.

***The test is worth 16 points**:*
– "excellent" – complete answer (at least 90% of the required information) – 16 points;
– "good" – a sufficiently complete answer (at least 75% of the required information), or a complete answer with minor inaccuracies – 15 – 8 points;
– "satisfactory" – incomplete answer (at least 60% of the required information) and minor errors – 7 - 1 points;
– "unsatisfactory" – the answer does not meet the requirements for "satisfactory" – 0 points.

***The homework test is estimated at 26 points according to the following criteria**:*
– "excellent" – creative approach to solving the problem – 26-18 points;
– "good" – deep disclosure of the problem, reflected own position – 17-10 points;
– "satisfactory" – reasonable disclosure of the problem with certain shortcomings – 9-1 points;
– "unsatisfactory" – the task was not completed, R&D was not credited – 0 points.
For each week of delay in submitting R&D, points are awarded – 2 points (no more than 8 points).
The presence of a positive mark on R&D is a condition for admission to the test.

At the test, students complete a written test consisting of 48 test questions.
The sum of starting points and points for the test is transferred to the credit grade according to the table:

Points: *practical classes + R&D + MKR + test work*	*Score*
100… 95	*Perfectly*
94… 85	*Very good*
84… 75	*Well*
74… 65	*Satisfactory*
64… 60	*Enough*
Less than 60	*Disappointing*
Module tests have not been passed or R&D has not been credited, or *Starting rating less than 25 points*	*Not allowed*

9. Additional information on the discipline (educational component)

Approximate list of issues to be submitted to the ICR

1. *What are the principles of regulation of the permissible anthropogenic load on the environment provided for by the Law on Environmental Protection?*
2. *Describe the climatic parameters and regimes taken into account in the planning and development of urban settlements, the design of buildings and structures?*

3. *What are the factors of the natural environment that affect the microclimatic conditions of the area?*
4. *What are the factors of the urban environment that influence the formation of the microclimate of the city?*
5. *Indicate the microclimatic variability of general climatic regimes in certain areas of a large city.*
6. *Specify the bioclimatic indicators of weather conditions.*
7. *What are the methods used to assess the bioclimate of a city?*
8. *Describe what meteorological factors determine the dispersion of impurities and aerosols in the air?*
9. *Explain what is the essence of the concept of "Air Pollution Potential"?*
10. *What are the environmental criteria for assessing the microclimate of a city?*
11. *Describe the ecological and microclimatic zoning of the city.*
12. *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 building area?*
13. *What are the methods used for a comprehensive assessment of the impact of natural and anthropogenic factors on the urban environment?*
14. *Explain what climatic and natural and man-made factors are taken into account in the development of urban planning and project documentation for the regulation, protection and environmental safety of the urban environment?*
15. *Give a classification of pollutants and sources of pollution in the urban environment.*
16. *Give examples of methods for protecting the building environment from internal and external vibrations.*
17. *Specify measures to protect the indoor environment from electromagnetic fields.*
18. *Explain the reasons for the radiation contamination of the building environment?*
19. *Provide radiation hygiene requirements during the construction and operation phases of the building.*
20. *What are the factors that determine the quality of the living environment at the urban level and on the scale of an individual building?*

Approximate tasks for R&D

1. Calculate the demographic capacity of the territory.

To determine the factors that limit the demographic capacity of the territory to the greatest extent, to propose measures to increase it.

Calculate the reproductive capacity of the territory by oxygen.

To draw a conclusion about the sufficiency of the reproductive ability of the territory in terms of oxygen.

2. Calculate the Air Pollution Index (ISA) in the city and the Comprehensive Air Pollution Index (KIZA). Assess the level of air pollution in the city.

3. Calculate the flow of water coming from various sources of natural and man-made nature, as well as the content of pollutants in them.

4. Calculate the area of the solid 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 pollution of urban soils, to establish which pollutants make the greatest contribution to the total pollution indicator. Characterize the geochemical anomalies detected, establishing which pollutants pose the greatest danger to ecosystems and human health. Field observation data are presented in the tables.

6. Develop an assortment of resistant plants and prepare proposals for landscaping various functional areas of the city.

Work program of the discipline (syllabus):

Compiled by *Assoc. Prof., Ph.D., Nosachova Y.V.*

Approved *by the Department of ___E and TRP___ (Minutes No. 17 dated 23.05.2024)*

Approved *by the Methodological Council of the IHF (Minutes No. 11 dated 28.06.2024)*