Normalization of Anthropogenic Load on Environment. Part 1.
Normalization of Anthropogenic Load on Environmentorking program of the discipline (Syllabus)

Details of the discipline	
Level of higher education	**The first (educational and professional)**
Branch of knowledge	*10 Natural Sciences*
Speciality	*101 Ecology*
Educational program	*Environmental safety*
Status of discipline	*Normative*
Form of training	*full-time/remote/mixed*
Year of preparation, semester	*3rd year, autumn semester*
Volume of discipline	4 ECTS credits (120 hours))
Semester control/ control measures	*Exam*
Schedule of classes	*3 hours a week (2 hours of lectures and 1 hour of practical classes)*
Language of instruction	*Ukrainian*
Information about course leader / teachers	*Lecturer: https://eco-paper.kpi.ua/pro-kafedru/vykladachi/shablij-tetyana-oleksandrivna.html* *Practical: https://eco-paper.kpi.ua/pro-kafedru/vykladachi/sirenko-lyudmila-viktorivna.html*
Course placement	*https://do.ipo.kpi.ua/course/view.php?id=2148*

Program of discipline

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

The purpose of studying this credit module is to form students' complex of knowledge, skills, skills necessary for qualified management of environmental activities at the level of industrial enterprises, institutions, organizations, at the level of departments of the Ministry of Environmental Protection and Natural Resources of Ukraine. In accordance with the goal, the preparation of bachelors requires the formation of the following competencies in students:

- *The 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 inform the public about the state of environmental safety and balanced nature management;*
- *The ability to master international and domestic experience in solving regional and cross-border environmental problems;*
- *The ability to develop projects for calculating maximum permissible discharges and emissions, to monitor compliance with MPD, MPE;*

- *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 discipline.

In accordance with the requirements of the educational and professional program, students after mastering the discipline must demonstrate the following learning outcomes:

- *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 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;*
- *To assess the state of the environment, to determine the level of impact of the company (production) on the environment, to determine the main pollutants of the environment of the company (production).*

2. Prerequisitions and requisition of disciplines (place in the structural and logical scheme of training according to the relevant educational program)

Study of the credit module «Normalization of Anthropogenic Load on Environment. Part 1. Normalization of Anthropogenic Load on Environment» is based on the principles of integration of various knowledge gained by students during the study of the following disciplines: «General Ecology», «Environmental Legislation and Environmental Law».

Credit module «Normalization of Anthropogenic Load on Environment. Part 1. Normalization of Anthropogenic Load on Environment» provides the disciplines «Environmental and Natural-Technogenic Safety», «Environmental Modelling and Forecasting. Basis of GIS», «Technoecology», «Environmental Protection Organization and Management», ensures the implementation of the bachelor's project.

3. Contents of the credit module

Section 1. Environmental protection system.
Topic 1. State System of Environmental Protection

Section 2. Protection of the atmosphere from anthropogenic influence
Topic 2. Sources of air pollution
Topic 3. Main provisions of the Law of Ukraine "On Protection of Atmospheric Air"
Topic 4. Factors that determine the surface concentration of pollution
Topic 5. Calculation of the concentration of contaminants in the surface layer
Topic 6. Development of standards maximum permissible emissions (MPE) for stationary sources

Section 3. Protection of the hydrosphere from anthropogenic influence

Topic 7. Use of water resources

Topic 8. Qualitative and quantitative changes in water resources under the influence of economic activity

Topic 9. Measures to protect surface water from pollution

Topic 10. Factors that affect the state of the water object

Topic 11. Calculation of maximum permissible discharges (MPD), determination of the required degree of water purification

Topic 12. Rules for receiving wastewater into municipal systems and sewerage systems' of settlements of Ukraine

4. Training materials and resources

Basic

1. *Гомеля М.Д., Шаблій Т.О., Глушко О.В. та ін.. Екологічна безпека. Навч. посібник. – К.: ТОВ «Інфодрук», 2009. – 245 с.*
2. *Нормування антропогенного навантаження на навколишнє середовище : підручник для студентів вищих навчальних закладів / [Н. В. Максименко, О. Г. Владимирова, А. Ю. Шевченко, Е. О. Кочанов]. – 3-тє вид., доп. і перероб. – Х. : ХНУ імені В. Н. Каразіна, 2016. – 264 с.*
3. *Нормування антропогенного навантаження на навколишнє середовище. Навчальний посібник з практичних (семінарських) занять [Електронний ресурс]: навч. посіб. для студ. спеціальності 101 «Екологія» / КПІ ім. Ігоря Сікорського; уклад.: Т. О. Шаблій, Л. В. Сіренко, М. Д. Гомеля. – Електронні текстові дані (1 файл: 179 кбайт). – Київ: КПІ ім. Ігоря Сікорського, 2022. – 51 с. https://ela.kpi.ua/handle/123456789/46513*
4. *Нормування антропогенного навантаження на навколишнє середовище. Курсова робота [Електронний ресурс]: навч. посіб. для студ. спеціальності 101 «Екологія» / КПІ ім. Ігоря Сікорського; уклад.: Т. О. Шаблій, Л. В. Сіренко, М. Д. Гомеля. – Електронні текстові дані (1 файл: 307 кбайт). – Київ: КПІ ім. Ігоря Сікорського, 2022. – 57 с. https://ela.kpi.ua/handle/123456789/46512*

Auxiliary (d)

1. *Нормування антропогенного навантаження на навколишнє середовище. Частина 1. Нормування інгредієнтного забруднення: навчальний посібник / Петрук В.Г., Васильківський І.В., Іщенко В.А., Петрук Р.В., Турчик П. М. – Вінниця : ВНТУ, 2013. – 253 с.*
2. *Нормування антропогенного навантаження на навколишнє середовище/ Курсове проектування: навчальний посібник / В.Г. Петрук, І.В. Васильківський, В.А. Іщенко, П.М. Турчик, С.М. Кватернюк. – Вінниця: ВНТУ, 2012. – 146 с.*
3. *Екологія і закон. Екологічне законодавство України. У двох книгах. Київ: Юрінком Інтер, 1997. Книга 1–698 с., книга 2–574 с.*
4. *Збірник законодавчих актів України про охорону навколишнього природного середовища. Збірник у 7-и томах. Чернівці: Зелена Буковина, 1997-2002 р.-т.1-344 с., т.2-336 с., т.3-477 с., т.4-382 с., т.5-343 с., т.6-345 с., т.7-343 с.*
5. *Державні санітарні правила охорони атмосферного повітря населених місць (від забруднення хімічними і біологічними речовинами). Київ: Міністерство охорони здоров'я України, 1997-31 с.*

6. *Михайлюк, Ю. Д. Нормування антропогенного навантаження на навколишнє середовище : практикум. – Івано-Франківськ: ІФНТУНГ, 2018. – 73 с.*
7. *Тарасова В.В., Малиновський А.С., Рибак М.Ф. Екологічна стандартизація і нормування антропогенного навантаження на природне середовище: Навч. посібник. – К.: Ніка-Центр, 2007. – 372 с.*
8. *Некос В.Ю., Максименко Н.В., Владимирова О.Г. та ін. Нормування антропогенного навантаження на навколишнє природне середовище: Навч. посібник. – К.: Кондор, 2007. – 288 с.*
9. *Radovenchyk V. Development of air quality monitoring system in Kyiv on the way of modernization environmental safety of sustainable development / V. M. Radovenchyk, O. I. Ivanenko, T. O. Shabliy, T. V. Krysenko, I. V. Radovenchyk // IOP Series: Earth and environmental science. 2022. P. 1-10.*

Information resources on the Internet

1. Ministry of Environmental Protection and Natural Resources of Ukraine - https://mepr.gov.ua/
2. State Statistics Service of Ukraine - http://www.ukrstat .gov.ua
2. Ecological portal of Ukraine – http://www.ecolog.org.ua/
3. Vernadsky Library – www.nbuv.gov.ua
4. Electronic archive of scientific and educational materials of KPI named after Igor Sikorsky - ELAKPI URL: https://ela.kpi.ua

Educational content

5. Methods of mastering the discipline (educational component)

Lecture classes

Lectures are aimed at:

- providing modern, holistic, interdependent knowledge from the credit module " Normalization of Anthropogenic Load on Environment. Part 1. Normalization of Anthropogenic Load on Environment ", the level of which is determined by the target installation for each specific topic;

- ensuring in the process of lecturing the creative work of students together with the teacher;

- education of students of professional and business qualities and development of their independent creative thinking;

- formation of the necessary interest in students and providing direction for independent work;

- determination at the current level of knowledge and methods of reducing anthropogenic load on the environment;

- display of methodological processing of the material (allocation of the main provisions, conclusions, recommendations, clear and adequate to their formulations);

- use for demonstration of visual materials, combining, if possible, them with the demonstration of results and samples;

- teaching research materials in a clear and high-quality language in compliance with structural and logical relations, explaining all the newly introduced terms and concepts;

- accessibility for perception by this audience.

No s/p	*Title of the lecture topic and list of main questions (list of didactic means, references to literature and tasks on the IWS)*	*Number of hours*
1-2	*State system of environmental protection.*	*4*

	The concept of environmental protection and environmental safety. State System of Environmental Protection (SONPS). The main activities of the state SONPS. ***Literature: 1, 2, 1d.*** *Tasks on the IWS. Specially authorized bodies in the ONS. Definition of the ONS system and its main tasks. Protected objects. Observation, forecasting, accounting and information in the ONS.*	
3	*Sources of air pollution.* *Sources and types of air pollution. Types of harmful effects and pollutants of the atmosphere. The concept of maximum permissible concentration (MPC) and maximum permissible emission (MPE).* ***Literature: 1, 2, 2d, 4d, 5d.*** *Tasks on the IWS. Harmful effects and pollution. Chemical composition, physicochemical properties of aerosols, sources of their entry into the atmosphere. Changes in the chemical composition of atmospheric air and the dynamics of the Earth's climate. Change in carbon dioxide concentration. Conversion of carbohydrates in the atmosphere. Aerosols in the troposphere.*	*2*
4	*The main provisions of the Law of Ukraine "On protection of atmospheric air".* *Management in the field of atmospheric air protection. Obligations of enterprises, institutions, organizations. Conditions for emissions into the atmospheric air. Measures to reduce air pollution by vehicles. Use of air as a raw material. Organization and economic measures to increase the efficiency of air use. Control, accounting and monitoring in the field of atmospheric air protection.* ***Literature: 1, 3d, 5d, 4d, 5d.*** *Tasks on the IWS. Air Code of Ukraine. Permits and limits on emissions of harmful substances.*	*2*
5	*Factors that determine the surface concentration of pollution.* *Emissions power. Turbulent air diffusion. Dangerous wind speed. Terrain. Temperature factor. The concept of inversion. Physicochemical nature of pollutants. The height of the ejection source.* ***Literature: 1, 2, 1d.*** *Tasks on the IWS. Acid rain. Destruction of the ozone layer. Measures to protect the oznosphere. Montreal Protocol on substances that deplete the ozone layer. Man-made climate change in large cities. Air temperature. The island is warm. Temperature inversion. Radiation. Wind speed. Haze fogs of smog and visibility in cities.*	*2*
6	*Calculation of the concentration of contaminants in the surface layer.* *Zones of pollution reduction. Calculation of the concentration of substances of unidirectional toxic action. Determination of the maximum concentration of pollution in the surface layer. Calculation of the maximum concentration of pollution and the distance along the O-X axis to the place of their formation under conditions when the wind speed differs from the most dangerous. Determination of the concentration of pollution along the O-X axis in the directions perpendicular to the A-X axis (along the axis Y and Z).* ***Literature: 1, 2, 3, 4, 2d.***	*2*

	Tasks on the IWS. The main factors influencing the formation of pollution concentrations in the surface layer. Classification of sources of air pollution.	
7	*Calculation of air pollution by emissions of a group of sources.* *Calculation of the maximum total concentration of pollution from N near the same single sources.* ***Literature: 1, 2, 3, 4.*** *Tasks on the IWS. Taking into account background concentrations when calculating atmospheric pollution and setting the background by calculations.*	*2*
8	*Development of standards of maximum permissible and temporarily agreed emissions (MPE) for stationary sources.* *General provisions. Calculation of MPE for individual sources and groups of emission sources. Determination of the boundaries of the sanitary-protective zone. Composition and content of the MPE project.* ***Literature: 1, 2, 3, 4, 2d.*** *Tasks on the IWS. Determination of the concentration of pollution in emissions from the group of sources. Definition of MPE for a group of sources.*	*2*
9	*Use of water resources.* *Classification of water use entities. Water supply to the population. Water supply industry. Water consumption by agriculture. Reservoir. Total water consumption. Use of water resources of Ukraine.* ***Literature: 1, 2, 1d, 3d, 7d.*** *Tasks on the IWS. Water users and water users. Household and drinking water supply.*	*2*
10	*Qualitative and quantitative changes in water resources under the influence of economic activity.* *The impact of industry on water bodies. Impact on water bodies of household (municipal) wastewater. Urbanization and its impact on water basins. Effect of reclamation measures on water bodies. Change in water quality in reservoirs. Pollution of water bodies in Ukraine.* ***Literature: 1, 2, 1d, 3d.*** *Tasks on the IWS. The impact of economic activity on the hydrosphere. Protection of the world's oceans. Sources and types of ocean pollution. Composition and volume of pollutants in the ocean. Man-made radionuclides.*	*2*
11	*Measures to protect surface water from pollution.* *Rationing of water quality depending on the category of water object. Engineering methods of protection of reservoirs. Processes of self-purification of water.* ***Literature: 1, 2, 1d, 3d.*** *Tasks on the IWS. Classification of reservoirs depending on water use. Water protection and forest protection zones. Protection of small rivers.*	*2*
12	*Formation of water quality in low-water period of the year* *Fluctuations in runoff and freshwater supply. Changes in the hydrochemical characteristics of water, the formation of water quality. Assessment of the natural quality of water in low-water period.* ***Literature: 1.***	*2*

	Tasks on the IWS. Protection of water bodies from exhaustion.	
13	*Factors that affect the condition of the water object.* *Wastewater dilution. Transformation of pollutants.* ***Literature: 1, 2, 1d, 8d.*** *Tasks on the IWS. Problems of anthropogenic pollution of the oceans.*	*2*
14	*The procedure for the development and approval of maximum permissible discharges (MPD) of substances into water bodies with return waters.* *Basic concepts and terms. Methodological and organizational basis for the establishment of MPD substances. Composition of the initial data and settlement conditions. Control over compliance with the established restrictions on the discharge of return waters.* ***Literature: 1, 2, 4d, 8d.*** *Tasks on the IWS. Responsibility of legal entities for the development of GDS.*	*2*
15	*Calculation of MPD, determination of the required degree of water purification.* *Determination of the characteristics of the flow necessary for the calculation of wastewater dilution. Determination of meteorological and hydraulic characteristics of the reservoir necessary for the calculation of wastewater dilution. Calculation of MPD, determination of the permissible amount of discharged wastewater, the required degree of their purification.* ***Literature: 1, 3, 4, 2d.*** *Tasks on the IWS. Determination of the effectiveness of treatment plants depending on the quality of return waters and the characteristics of reservoirs.*	*2*
16-17	*Rules for receiving wastewater into municipal systems and sewage systems of settlements of Ukraine.* *General provisions. General requirements for the composition and properties of wastewater discharged into the city sewerage system. Determination of permissible concentrations of pollutants in the wastewater of the enterprise. Determination of the amount of payment of enterprises for discharge of wastewater into the city sewerage system.* ***Literature: 1.*** *Tasks on the IWS. Determination of permissible concentrations of pollutants in the wastewater of the enterprise.*	*4*
18	*Final lecture.*	*2*
	Total hours	*36*

Practical classes

In the system of professional training of students, practical classes occupy 33 % of the classroom load. Being an addition to the lecture course, they lay and form the basics of a bachelor's qualification in ecology. The content of these classes and the methodology of their implementation ensure the development of creative activity of the individual. They develop scientific thinking and the ability to use special terminology, allow you to test knowledge, in connection with which this type of work acts as an important means of operational feedback. Therefore, practical classes perform not only cognitive and educational functions, but also contribute to the growth of students as creative workers in the field of ecology.

The main tasks of the cycle of practical classes:

- *help students systematize, consolidate and deepen knowledge of a theoretical nature in the field of environmental protection;*
- *teach students techniques for solving practical problems, promote mastering the skills and abilities of performing calculations, graphic and other types of tasks;*
- *teach them to work with scientific and reference literature, documentation and schemes;*
- *to form the ability to learn independently, that is, to master the methods, methods and techniques of self-study, self-development and self-control.*

No s/p	*The name of the topic of the lesson and the list of main questions (list of didactic support, references to literature and tasks to the IWS)*	*Number of hours*
1	*Determination of the concentration of pollutants contained in emissions into the atmosphere.* *Determination of the consumption of gas emissions generated by burning fuel.* *Determination of the emission power of the main pollutants when burning fuel.* ***Literature: 1, 3, 4, 2d.*** *Tasks on the IWS. Determination of the efficiency of treatment plants depending on the composition of the initial gases.*	*2*
2	*Determination of the maximum concentration of pollution in the surface layer with hot emissions from a single source.* *Determination of the maximum concentration of contaminants in the surface layer in cold emissions from a single source.* ***Literature: 1, 3, 4, 2d.*** *Calculation of the maximum total concentration of pollution from N near the same single sources.*	*2*
3	*Determination of the distance at which the maximum concentration of pollution in the surface layer is achieved.* *Determination of the concentration of contaminants at different distances from the source of the emission.* *Determination of the boundaries of the sanitary-protective zone.* ***Literature: 1, 3, 4, 2d.*** *Determination of the concentration of pollution on the axis O-X in the direction perpendicular to the axis O-X (on the axis Y).*	*2*
4	*Determination of the maximum concentration of pollution in the surface layer at an unfavorable wind speed and the distance at which it is achieved.* *Determination of the minimum height of the source of emission.* ***Literature: 1, 3, 4, 2d.*** *Tasks on the IWS. Conditions for combining a group of emission sources.*	*2*
5	*Determination of maximum permissible emissions of harmful substances.* ***Literature: 1, 3, 4, 2d.*** *Tasks on the IWS. Definition of MPD for a group of sources.*	*2*
6	*Calculation of the coefficient of mixing of return waters with water of the water object and the multiplicity of dilution of return waters.* *Justification and calculation of the maximum permissible concentration of impurities in purified return waters and the degree of purification.* ***Literature: 1, 3, 4, 2d.***	*2*

	Tasks on the IWS. Determination of meteorological and hydraulic characteristics of the reservoir necessary for the calculation of wastewater dilution.	
7	*Calculation of the required degree of purification of return waters for complete biological oxygen consumption.* *Determination of standards of MPD of substances entering a natural object with return waters.* ***Literature: 1, 3, 4, 2d.*** *Tasks on the IWS. Determination of permissible concentrations of pollutants in the wastewater of the enterprise.*	*2*
8	*Evaluation of the efficiency of treatment plants.* *Forecast of changes in water quality in the control creature.* ***Literature: 1, 3, 4, 2d.*** *Tasks on the IWS. Determination of the effectiveness of treatment plants depending on the quality of return waters and the characteristics of reservoirs.*	*2*
9	*Modular control test*	*2*
	Total hours	

Independent work

Independent work of students takes 55 % of the time to study the credit module, also includes preparation for the exam. The main task of independent work of students is the mastery of scientific knowledge in the field of environmental protection, which are not included in the list of lecture issues, through personal search for information, the formation of an active interest in the creative approach in educational work. In the process of independent work within the credit module, the student must learn to deeply analyze the problem of rationing anthropogenic load on the environment and, based on calculations, come to their own reasonable conclusions.

No s/p	*Name of the topic submitted for self-study*	*Number of hours of IWS*
Section 1. Environmental protection system		
1	*Specially authorized bodies in the ONS. Definition of the ONS system and its main tasks. Protected objects. Observation, forecasting, accounting and information in the ONS.* ***Literature: 1, 2, 1d.***	*4*
Section 2. Protection of the atmosphere from anthropogenic influence		
2	*Harmful effects and pollution. Chemical composition, physicochemical properties of aerosols, sources of their entry into the atmosphere. Changes in the chemical composition of atmospheric air and the dynamics of the Earth's climate. Change in carbon dioxide concentration. Conversion of carbohydrates in the atmosphere. Aerosols in the troposphere.* ***Literature: 1, 2, 3, 4, 2d.*** *Air Code of Ukraine. Permits and limits on emissions of harmful substances.* ***Literature: 1, 2, 3, 4, 2d.*** *Acid rain. Destruction of the ozone layer. Measures to protect the oznosphere. Montreal Protocol on substances that deplete the ozone layer. Man-made climate change in large cities. Air temperature. The island is warm.*	*15*

	Temperature inversion. Radiation. Wind speed. Haze fogs of smog and visibility in cities. ***Literature: 1, 2, 3, 4, 2d.*** *The main factors influencing the formation of pollution concentrations in the surface layer. Classification of sources of air pollution.* ***Literature: 1, 2, 3, 4, 2d.*** *Taking into account background concentrations when calculating atmospheric pollution and setting the background by calculations.* ***Literature: 1, 2, 3, 4, 2d.*** *Determination of the concentration of pollution in emissions from the group of sources. Definition of MPE for a group of sources.* ***Literature: 1, 2, 3, 4, 2d.*** *Determination of the efficiency of treatment plants depending on the composition of the initial gases.* ***Literature: 1, 2, 3, 4, 2d.*** *Calculation of the maximum total concentration of pollution from N closely placed identical single sources.* ***Literature: 1, 2, 3, 4, 2d.*** *Determination of the concentration of pollution along the axis O-X in the direction perpendicular to the axis O-X (on the axis Y).* ***Literature: 1, 2, 3, 4, 2d.*** *Conditions for combining a group of emission sources.* ***Literature: 1, 2, 3, 4, 2d.*** *Definition of GDS for a group of sources.* ***Literature: 1, 2, 3, 4, 2d.***	
Section 3. Protection of the hydrosphere from anthropogenic influence		
3	*Water users and water users. Household and drinking water supply.* ***Literature: 1, 2, 1d, 3d.*** *The impact of economic activity on the hydrosphere. Protection of the world's oceans. Sources and types of ocean pollution. Composition and volume of pollutants in the ocean. Man-made radionuclides.* ***Literature: 1, 2, 1d, 3d.*** *Classification of reservoirs depending on water use. Water protection and forest protection zones. Protection of small rivers. Protection of water bodies from exhaustion.* ***Literature: 1, 2, 1d, 3d.*** *Problems of anthropogenic pollution of the oceans.* ***Literature: 1, 2, 1d, 3d.*** *Responsibility of legal entities for the development of MPD.* ***Literature: 1, 3d.*** *Determination of the effectiveness of treatment plants depending on the quality of return waters and the characteristics of reservoirs.* ***Literature: 1, 3, 4, 2d.*** *Determination of permissible concentrations of pollutants in the wastewater of the enterprise.* ***Literature: 1, 3, 4, 2d.***	*12*

	Determination of meteorological and hydraulic characteristics of the reservoir necessary for the calculation of wastewater dilution. ***Literature: 1, 3, 4, 2d.*** *Determination of permissible concentrations of pollutants in the wastewater of the enterprise.* ***Literature: 1, 3, 4, 2d.*** *Determination of the effectiveness of treatment plants depending on the quality of return waters and the characteristics of reservoirs.* ***Literature: 1, 3, 4, 2d.***	
4	*Preparation for MCT*	*5*
5	*Preparation for the exam*	*30*
	Total hours	*66*

Provision of program results by components of the educational component

Learning outcomes	*Lecture classes*	*Seminars, laboratory classes, individual tasks*
To use the management principles on which the environmental safety system is based	*Lecture 1-2. State system of environmental protection.*	
To solve problems in the field of environmental protection using generally accepted and / or standard approaches and international and national experience	*Lecture 3. Sources of air pollution.* *Lecture 4. The main provisions of the Law of Ukraine "On protection of atmospheric air".* *Lecture 9. Use of water resources.* *Lecture 10. Qualitative and quantitative changes in water resources under the influence of economic activity.* *Lecture 11. Measures to protect surface water from pollution.*	*Practical classes 1. Determination of the concentration of pollutants contained in emissions into the atmosphere. Determination of the consumption of gas emissions generated by burning fuel. Determination of the emission power of the main pollutants when burning fuel.*
To be able to predict the impact of technological processes and industries on the environment	*Lecture 5. Factors that determine the surface concentration of pollution.* *Lecture 13. Factors that affect the condition of the water object.* *Lecture 12. Formation of water quality in low-water period of the year*	*Practical classes 4. Determination of the maximum concentration of pollution in the surface layer at an unfavorable wind speed and the distance at which it is achieved. Determination of the minimum height of the source of emission.* *Practical classes 6. Calculation of the coefficient of*

		mixing of return waters with water of the water object and the multiplicity of dilution of return waters. Justification and calculation of the maximum permissible concentration of impurities in purified return waters and the degree of purification. *Practical classes 8. Evaluation of the efficiency of treatment plants. Forecast of changes in water quality in the control creature.*
To participate in the development and implementation of projects aimed at optimal management and treatment of industrial and municipal waste	*Lecture 6. Calculation of the concentration of contaminants in the surface layer.* *Lecture 7. Calculation of air pollution by emissions of a group of sources.* *Lecture 16-17. Rules for receiving wastewater into municipal systems and sewage systems of settlements of Ukraine.*	*Practical classes 2. Determination of the maximum concentration of pollution in the surface layer with hot emissions from a single source. Determination of the maximum concentration of contaminants in the surface layer in cold emissions from a single source.*
To be able to explain the social, economic and political consequences of implementing environmental projects	*Lecture 1-2. State system of environmental protection.*	*Practical classes 3. Determination of the distance at which the maximum concentration of pollution in the surface layer is achieved. Determination of the concentration of contaminants at different distances from the source of the emission. Determination of the boundaries of the sanitary-protective zone.*
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	*Lecture 8. Development of standards of maximum permissible and temporarily agreed emissions (MPE) for stationary sources.* *Lecture 14. The procedure for the development and approval of maximum permissible discharges*	*Practical classes 5. Determination of maximum permissible emissions of harmful substances.* *Practical classes 7. Calculation of the required degree of purification of return waters for complete biological oxygen consumption.*

discharges and maximum allowable emissions	*(MPD) of substances into water bodies with return waters.* *Lecture 15. Calculation of MPD, determination of the required degree of water purification.*	*Determination of standards of MPD of substances entering a natural object with return waters.*
To assess the state of the environment, to determine the level of impact of the company (production) on the environment, to determine the main pollutants of the environment of the company (production).	*Lecture 3. Sources of air pollution.* *Lecture 9. Use of water resources.* *Lecture 10. Qualitative and quantitative changes in water resources under the influence of economic activity.* *Lecture 11. Measures to protect surface water from pollution.*	

Politics and control

6. Policy of discipline (educational component)

Rules for attending 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 to conduct classes, not to be distracted by actions that are not related to the educational process.

Rules for assigning incentive and penalty points

encouraging points can be credited by the teacher only for the performance of creative works in the discipline or additional passage of online specialized courses with the receipt of the appropriate certificate:

- *https://ru.coursera.org/learn/globalenergyandclimatepolicy*
- *https://ru.coursera.org/learn/ecology-conservation*
- *https://ru.coursera.org/learn/water-management*
- *https://ru.coursera.org/learn/global-environmental-management*
- *https://ru.coursera.org/learn/intro-indoor-air-quality*
- *https://alison.com/courses/diploma-in-environmental-quality-monitoring-and-analysis/content*

Enrollment of a certificate from a certain online profile course is one-time.

However, their amount cannot exceed 10 % of the rating scale.

Penalty points within the discipline are not provided.

Deadline and overlay policy

In case of debts in the discipline or any force majeure circumstances, students should contact the teacher through accessible (provided by the teacher) communication channels to solve problematic issues and coordinate the algorithm of actions for working out.

Academic Integrity Policy

Plagiarism and other forms of dishonest work are unacceptable. Plagiarism includes the absence of references when using printed and electronic materials, quotes, opinions of other authors. Invalid hints and write-offs when writing tests, conducting classes; passing the credit for another student; copying of 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 Section 3 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"https://kpi.ua/code.

Policy of academic behavior and ethics

Students should be tolerant, respect the opinion of others, object to formulate in the correct form, 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"https://kpi.ua/code.

7. Types of control and rating system for assessing learning outcomes (RCOs)

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

Semester	School time		Distribution of training hours			Control measures		
	Loans	acad. H.	Lecture	Seminar.	IWS	MCT	Indus.	Semester certification
5	4	120	36	18	66	1	-	Exam

The student's rating from the credit module consists of points that he receives for:

1. three control works (MCT is divided into 3 works lasting 30 minutes)

2. implementation of 17 practical works

3 response to the exam.

System of rating (weight) points and evaluation criteria:

1. Modular control test.

Weight point: for MCT-1 – 9 points, for MCT-2 and MCT-3 – 16 points each. The maximum number of points for all control works is equal to: 9 points + 16 points x 2 papers = 41 points

The task of the control work consists of: MCT-1 – open questions, for MCT-2 and MCT-3 – test questions (16 units each), to the corresponding sections of the syllabus of the credit module.

Each question of the control work is estimated at 1 point.

2. Work in practical classes.

Weight point – 1. The maximum number of points in all practical works is equal to: 1 point x 17 tasks = 17 points

Criteria for assessing students' knowledge

Mark	Completeness of the answer
1	Timely full implementation of the year, settlements in full, registration of p/r.
0,5	Minor deficiencies in paragraph 1. Untimely execution of p/r.
0	Non-fulfillment of p/r

Thus, the rating semester scale of the credit module is:

$$R_C=9*1+16*2+17*1=58 \text{ points}$$

The exam component is 42% of R:

$$R_{ex}=42 \text{ points}$$

Thus, the rating scale from the credit module is:

$$R=R_C+R_{IVF}=58+42=100 \text{ points}$$

The maximum amount of points of the starting component is 58 points. A prerequisite for admission to the exam is the enrollment of all practical classes and the starting rating of at least 30 points.

According to the results of educational work for the first 7 weeks, the "ideal student" should score 29 points. At the first certification (8th week), the student receives "enrolled" if his current rating is not less than 14 points.

According to the results of educational work for 13 weeks of study, the "ideal student" should score 58 points. At the second certification (week 14), the student receives "enrolled" if his current rating is not less than 29 points.

At the exam, the student performs written test work (42 units). Each question is rated at 1 point. The total number of points for the test is 42.

The amount of starting points and points for the exam is transferred to the examination assessment according to the table.

Points $R=R_C+R_{ECC}$	Score
95...100	Perfectly
85...94	Very good
75...84	Well
65...74	Satisfactory
60...64	Enough
less than 60	Disappointing
Uncalculated practical work or $R_C<30$	not allowed

Credit module work program (syllabus):
Compiled *prof., Doctor of Technical Sciences, Shabliy T.O.*

Approved *by the* ***Ecology and technology of plant polymers*** *(protocol No 17 from 23.05.2024)*
Approved *by the CEF Methodical Commission (protocol No.10 of 28.06.2024)*