Coursework in Normalization of Anthropogenic Load on Environment

Working 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	1 credit ECTS (30 hours)
Semester control/ control measures	*test*
Schedule of classes	*Independent work*
Language of instruction	*Ukrainian*
Information about course leader / teachers	*Consultant: 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 discipline is the formation of 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 units 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 conduct research at an appropriate level;*
- *The ability to evaluate and ensure the quality of the work performed;*
- *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 develop project and working technical documentation in the field of environmental protection technologies, to compose structural schemes with elements of equipment and industrial buildings, to draw up completed design and construction developments;*
- *The ability to develop projects for calculating maximum permissible discharges and emissions, to monitor compliance with MPD, MPE.*

1.2. The main tasks of the discipline.

After mastering the discipline, students must demonstrate the following learning outcomes:

- To use the management principles on which the environmental safety system is based;

- To know the conceptual basis of monitoring and regulation of anthropogenic load on the environment;

- To be able to use software, GIS-technologies and Internet resources for information support of environmental research

- 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 understand the responsibility for the effectiveness and consequences of comprehensive environmental measures;

- To be able to choose the best methods and tools for research, data collection and processing;

- 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.

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 «Coursework in 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», «Urbosecology».

Credit module «Coursework in 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. Content of discipline

Section1. Calculation of air pollution by emissions from a single source

Topic 1. Determination of the maximum concentration of contaminants in the surface layer from a single source

Topic 2. Determination of the distance at which the maximum concentration of pollution in the surface layer is achieved

Topic 3. Determination of dangerous wind speed; maximum surface concentration of pollution and the distance at which it is achieved, at wind speed, which differs from dangerous

Topic 4. Determination of the concentration of contaminants at different distances from the source on the axis of the ejection torch, on the perpendicular to it and the radius of the source impact zone

Topic 5. Determination of the minimum height of the source of emission

Topic 6. Determination of maximum permissible emissions (MPE) of harmful substances

Section 2. Calculation of contamination of the water object with return waters for a separate concentrated release

Topic 1. Calculation of the coefficient of mixing of return waters with water of a water object and multiplicity of dilution of return waters

Topic 2. Calculation of the maximum permissible concentration of toxic suspended substances in purified return waters

Topic 3. Calculation of the maximum permissible value of BSK_p in the dropped return waters

Topic 4. Determination of the standards of the maximum permissible discharges (MPD), substances entering a water object with return waters

Topic 5. Forecast of changes in water quality in the control system

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. *Методика расчета концентраций в атмосферном воздухе вредных веществ, содержащихся в выбросах предприятий. ОНД – 86. Ленинград: Гидрометиоиздат, 1987 –93 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.*

Information resources on the Internet

1. Ministry of Environmental Protection and Natural Resources of Ukraine - *https://mepr.gov.ua/*

2. Ecological portal of Ukraine – *www.ecologya.com.ua*

3. Library name. V.I. Vernadsky – *www.nbuv.gov.ua*

4. Electronic archive of scientific and educational materials of KPI named after Igor Sikorsky – ELAKPI URL.

Educational content

5. Methods of mastering the discipline (educational component)

The discipline " Coursework in Normalization of Anthropogenic Load on Environment" consists of two sections, which have several units. The first section concerns the calculation and justification of the draft standards of the maximum permissible emission, the second – the draft standards of the maximum permissible discharge.

Practical assimilation of the discipline is achieved both by purposeful selection of the topic of individual classes, and by the organization of the process of coursework.

The explanatory note to the course work contains the following sections.

1. *Tasks for course work.*
2. *Detailed description of the solution process.*
3. *The results of calculations and their analysis (numerical, graphic, table value of the results of calculations).*
4. *Conclusions on each unit of work, on the work as a whole in terms of recommendations for further environmental protection measures.*
5. *List of literature.*

3. Schedule of coursework

Semester Week	*Назва етану роботи*	*Number of hours*
1-2	*Get a theme and tasks*	*0,5*
3-5	*Selection and study of literature*	*4*
6	*Determination of the maximum surface concentration of pollutant in the surface layer from a single source*	*1*
7	*Determination of dangerous wind speed for the source of emission*	*0,5*
7	*Determination of the distance from the source of the ejection at which the surface concentration of impurities reaches the maximum value*	*0,5*
7	*Determination of surface concentration of impurities and distance from the source at wind speed, different from dangerous.*	*1*
8	*Calculation of the admixture concentration on the axis of the ejection source torch and the radius of the source impact zone.*	*3*
9	*Calculation of the minimum height of the source of emission*	*3*
10	*Calculation of the standards of MPE pollutant for a single source, taking into account the background concentrations of impurity*	*3*
11	*Calculation of the coefficient of mixing wastewater with water of a water object and the multiplicity of wastewater dilution*	*3*
12	*Determination of the maximum permissible concentration of suspended, toxic substances and the maximum permissible value of BSK in return waters to be discharged into a general economic or fisheries water object*	*3*
13	*Determination of the required degree of wastewater treatment to be discharged into a water bodies*	*2*

14	*Development of standards of MPD of pollutants discharged into a water object with return waters*	*3*
15	*Forecast of changes in water quality in the control creature of the water object.*	*1,5*
16	*View coursework for review*	*0,5*
17-18	*presentation of coursework*	*0,5*

Provision of program results by components of the educational component

Learning outcomes	*Individual tasks*
To use the management principles on which the environmental safety system is based	*Determination of the distance from the source of the ejection at which the surface concentration of impurities reaches the maximum value;* *Determination of surface concentration of impurities and distance from the source at wind speed, different from dangerous;* *Calculation of the admixture concentration on the axis of the ejection source torch and the radius of the source impact zone;* *Determination of the maximum permissible concentration of suspended, toxic substances and the maximum permissible value of BSK in return waters to be discharged into a general economic or fisheries water object.*
To know the conceptual basis of monitoring and regulation of anthropogenic load on the environment	*Determination of the maximum surface concentration of pollutant in the surface layer from a single sourc;.* *Calculation of the coefficient of mixing wastewater with water of a water object and the multiplicity of wastewater dilution;* *Determination of dangerous wind speed for the source of emission.*
To be able to use software, GIS-technologies and Internet resources for information support of environmental research	*Selection and study of literature.*
To be able to predict the impact of technological processes and industries on the environment	*Forecast of changes in water quality in the control creature of the water object.*
To participate in the development and implementation of projects aimed at optimal management and treatment of industrial and municipal waste	*Calculation of the minimum height of the source of emission;* *Determination of the required degree of wastewater treatment to be discharged into a water bodies.*
To understand the responsibility for the effectiveness and consequences of comprehensive environmental measures	*View coursework for review;* *presentation of coursework.*

To be able to choose the best methods and tools for research, data collection and processing	*Selection and study of literature.*
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	*Calculation of the standards of MPE pollutant for a single source, taking into account the background concentrations of impurity;* *Development of standards of MPD of pollutants discharged into a water object with return waters.*

Politics and control

6. Policy of discipline (educational component)

The discipline "Coursework in Normalization of Anthropogenic Load on Environment" is studied by students independently and involves counseling by a teacher. Students are obliged to perform individual tasks qualitatively and on time, submit it for verification and submit coursework to the defense in time.

Rules for assigning incentive and penalty points

Incentive and penalty points in this 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 copying of copyrighted material without the permission of the author of the work.

The policies 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:

The rating assessment in the discipline "Coursework in Normalization of Anthropogenic Load on Environment" has two components. The first (starter) characterizes the student's coursework and its result is the quality of the explanatory note. The second component characterizes the quality of the student's defense of coursework. The size of the scale of components is 50 points each.

Rating points system

1.The starting component (r_1) has two parts in its composition. The first part (r_{11}) concerns the implementation of the first section of the course work, the component (r_{12}) – the second section. For each of the starting components (r_{11}) and (r_{12}):

- timeliness of the relevant part of the course work – 2-1 points;

- correctness of application of methods of calculation, qualitative and quantitative assessment of the results obtained – 14-8;

- justification of recommendations for further environmental protection measures – 6-4 points.

- quality of design 3-1bals.

2. The component of the protection of coursework (r_2) accordingly contains two parts (r_{21}) and (r_{22}), each of which is evaluated:

- degree of ownership of the material 6-4 points;

- the degree of justification of the decisions taken and the correctness of the conclusions15-9 points;

- ability to defend your opinion 4-2 points.

The sum of the points of the two components is transferred to the scoring assessment according to the table:

Points $R=R_I+R_{II}$	*Score*
95…100	*Perfectly*
85…94	*Very good*
75…84	*Well*
65…74	*Satisfactory*
60…64	*Enough*
less than 60	*Disappointing*
Coursework is not allowed to be protected	*Not allowed*

8. Additional information from the credit module

Approximate list of topics (source data variants)

1. Determination of the maximum surface concentration of the pollutant for a cold source of emission.

2. Determination of the maximum surface concentration of the pollutant for the heated source of release.

3. Determination of dangerous wind speed for a cold source of emission.

4. Determination of dangerous wind speed for the heated source of emission.

5. Determination of the distance from the cold source of the ejection at which the surface concentration of the impurities reaches its maximum value.

6. Determination of the distance from the heated source of the ejection at which the surface concentration of the impurities reaches its maximum value.

7. Determination of surface concentration of impurities and distance from cold spring under dangerous meteorological conditions.

8. Determination of surface concentration of impurities and distance from the heated source under dangerous meteorological conditions.

9. Calculation of the concentration of impurities on the axis of the torch of a cold source of emission.

10. Calculation of the concentration of impurities on the axis of the torch of the heated source of emission.

11. Calculation of the minimum height of the cold source of emission.

12. Calculation of the minimum height of the heated source of emission.

13. Calculation of the standards of MPE pollutant for a single cold source, taking into account the background concentrations of impurity.

14. Calculation of the standards of MPE pollutant for a single heated source, taking into account the background concentrations of impurity.

15. Calculation of standards of MPE pollutant for a single cold source without taking into account background concentrations of impurities.

16. Calculation of standards of MPE pollutant for a single heated source without taking into account background concentrations of impurities.

17. Determination of the zone of influence of a single cold source of emission.

18. Determination of the zone of influence of a single heated source of emission.

19. Determination of the size of the sanitary protection zone and the category of danger of the enterprise.

20. Calculation of the multiplicity of dilution of wastewater by water to a fishery object.

21. Calculation of the multiplicity of dilution of wastewater by water of a general economic object.

22. Determination of the required degree of wastewater treatment to be discharged into a fishery water object.

23. Determination of the required degree of wastewater treatment to be discharged into a general economic water object.

24. Development of standards of MPD pollutants discharged into the water object of fisheries.

25. Development of standards of MPD pollutants discharged into a general economic water object.

26. Determination of the maximum permissible concentration of impurities in wastewater to be discharged into a fishery water object.

27. Determination of the maximum permissible concentration of impurities in wastewater to be discharged into a general economic water object.

28. Forecast of changes in water quality in the control creation of a water object for fisheries purposes.

29. Forecast of changes in water quality in the control creation of a general economic water object.

Table 1. Initial data for calculating air pollution by emissions from a single source

No p/p	D, m	M, g/s	V_1, m^3/s	w_0, m/s	N, m	U, m/s	TV ^0C	Ts ^0C
1	0.1	1	1	-	2	3	10	24
2	0.6	1	-	15	20	3	20	24
3	0.7	1	-	7	50	1	100	22
4	0.8	1	2	-	15	4	100	19
5	1.0	2	1	-	20	2	80	20
6	0.5	2	-	5	30	0.5	125	18
7	0.6	2	1	-	2	1	125	21
8	0.7	2	2	-	20	4	20	25
9	0.8	3	3	-	2	2	12	24
10	0.9	3	-	10	15	3	12	24
11	1.0	3	-	20	20	5	130	22
12	1.2	3	2	-	20	2	160	22
13	1.4	4	-	5	35	0.5	125	25
14	1.8	4	-	7	20	3	300	21
15	2.0	4	-	40	20	2	230	21
16	2.0	4	-	10	5	6	10	20
17	2.5	2	4	-	50	1	125	20
18	3.0	2	2	-	15	5	10	23
19	3.5	2	-	8	75	3	18	23
20	4.0	2	-	8	75	5	15	20
21	2.5	4	-	20	20	1	130	20
22	3.0	4	2	-	2	2	160	25
23	3.5	4	-	40	50	1	230	25
24	4.2	4	3	-	30	6	160	23
25	4.8	4	1	-	50	1	300	22
26	0.1	0.006	1	-	2	0.5	300	24
27	0.1	1	1	-	2	3	10	24
28	0.6	1	-	15	20	3	20	24
29	0.7	1	-	7	50	1	100	22
30	0.8	1	2	-	15	4	100	19

Table 2. Initial data for calculating air pollution by emissions from a single source

No p/p	Ejection substance	MPC, mg/m³	And	F	C_{F1}, mg/m³	C_{F2}, mg/m³
1	H_2SO_4	0.3	160	1	0.10 MPC	0.15 MPC
2	CO	5.0	160	1	0.21 MPC	0.20 MPC
3	SO_2	0.5	180	1	0.21 MPC	0.00 MPC
4	SO_2	0.5	160	1	0.16 MPC	0.15 MPC
5	CO	5.0	160	1	0.17 MPC	0.20 MPC
6	Ash	0.5	160	3	0.34 MPC	0.37 MPC
7	HCl	0.2	160	1	0.45 MPC	0.50 MPC
8	CO	5.0	180	1	0.56 MPC	0.60 MPC
9	NO_x	0.085	160	1	0.12 MPC	0.15 MPC
10	NO_x	0.085	160	1	0.11 MPC	0.00 MPC
11	Ash	0.5	160	3	0.02 MPC	0.05 MPC
12	H_2SO_4	0.3	180	1	0.03 MPC	0.10 MPC
13	H_2SO_4	0.3	160	1	0.14 MPC	0.20 MPC
14	CO	5.0	160	1	0.15 MPC	0.30 MPC
15	HCl	0.2	180	1	0.23 MPC	0.30 MPC
16	NO_x	0.085	160	1	0.24 MPC	0.00 MPC
17	Ash	0.5	160	3	0.17 MPC	0.20 MPC
18	CO	5.0	160	1	0.19 MPC	0.20 MPC
19	SO_2	0.5	160	1	0.18 MPC	0.00 MPC
20	NO_x	0.085	180	1	0.16 MPC	0.20 MPC
21	SO_2	0.5	160	1	0.23 MPC	0.30 MPC
22	HCl	0.2	160	1	0.24 MPC	0.00 MPC
23	H_2SO_4	0.3	160	1	0.36 MPC	0.30 MPC
24	Ash	0.5	180	3	0.41 MPC	0.50 MPC
25	HCl	0.2	160	1	0.42 MPC	0.50 MPC
26	NO_x	0.085	160	1	0.70 MPC	0.00 MPC
27	H_2SO_4	0.3	160	1	0.10 MPC	0.15 MPC
28	CO	5.0	160	1	0.21 MPC	0.20 MPC
29	SO_2	0.5	180	1	0.21 MPC	0.00 MPC
30	SO_2	0.5	160	1	0.16 MPC	0.15 MPC

Table.3. Initial data to determine the mixing coefficient, dilution multiplicity, reageration constants and the rate constant of oxygen consumption by wastewater.

№	Water consumption of the water object, Q, m^3/s	Wastewater consumption, q, m^3/s	The average flow rate of a water object, V_{wed}. m/s	Average depth of water object, H_{wed}, m	The average water temperature of a water object in summer, T, ^0C	Torque factor, j	Coefficient taking into account the place of discharge, x	Distance from discharge site to control creation, L, km
1	30	0.6	0.64	1.2	15	1.0	1.0	35.0
2	20	0.5	0.64	1.2	15	1.0	1.5	0.5
3	30	0.6	0.6	1.0	15	1.2	1.0	35.0
4	20	0.5	0.6	1.0	15	1.2	1.5	0.5
5	0.8	0.18	0.2	0.3	12	1.0	1.0	10.0
6	0.6	0.14	0.25	0.38	12	1.0	1.5	10.0
7	0.8	0.18	0.2	0.3	12	1.2	1.0	0.5
8	0.6	0.14	0.25	0.38	12	1.2	1.5	0.5
9	1.2	0.2	0.53	0.9	9	1.0	1.0	20.0
10	1.4	0.3	0.4	1.2	9	1.0	1.0	0.5
11	1.2	0.2	0.53	0.9	9	1.2	1.5	20.0
12	1.4	0.3	0.4	1.2	9	1.2	1.5	0.5
13	1.7	0.05	0.5	1.4	10	1.0	1.5	5.0
14	1.7	0.025	0.6	1.0	10	1.0	1.5	0.5
15	1.7	0.05	0.5	1.4	10	1.2	1.0	5.0
16	1.7	0.025	0.6	1.0	10	1.2	1.0	0.5
17	1.5	0.08	0.45	2.0	18	1.0	1.5	2.0
18	1.6	0.07	0.4	1.5	18	1.0	1.5	0.5
19	1.5	0.08	0.45	2.0	18	1.2	1.0	2.0
20	1.6	0.07	0.4	1.5	18	1.2	1.0	0.5
21	10	0.4	0.2	0.3	13	1.0	1.5	1.0
22	10	0.5	0.3	0.2	13	1.0	1.5	1.0
23	12	0.6	0.2	0.3	13	1.2	1.0	0.5
24	12	0.5	0.3	0.2	13	1.2	1.0	0.5
25	12	0.5	0.2	0.5	13	1.0	1.5	8.0
26	0.8	0.1795	0.2	0.3	14	1.2	1.5	0.5
27	30	0.6	0.64	1.2	15	1.0	1.0	35.0
28	20	0.5	0.64	1.2	15	1.0	1.5	0.5
29	30	0.6	0.6	1.0	15	1.2	1.0	35.0
30	20	0.5	0.6	1.0	15	1.2	1.5	0.5

Table 4. Initial data to determine the permissible concentrations of impurities in wastewater C_{ST}, the required degree of purification Z, the value of the GDS and the forecast values of the concentration of impurities in the control creature $C_{ST\,p}$

Indicators of the composition of return waters	*MPC, mg/l*	*Background concentration C_F, mg/l*	*Concentration of impurities according to the technological scheme, $C_{technol}$, mg / l*	*Maxim. permissible concentration of impurities, c_{ST}, mg/ l*	*Admixture concentration for determination of GDS, C^{GDS} mg/l*	*GDS, g/h*	*Concentration of impurities in the control creature, C_{ST}^{pr}, mg / l*
Hanging substances	*0.25*	*12.6*	*9.0*				
BSK	*3.0*	*10.6*	*4.8*				
Chlorides	*300.0*	*23*	*300*				
Sulphates	*100.0*	*38*	*200*				
Mineralization	*1000*	*337*	*1000*				
Ammonium nitrogen	*0.5*	*0.5*	*7*				
Nitrites nitrogen	*0.08*	*0.02*	*0.1*				
Nitrate nitrogen	*40.0*	*0.2*	*1.5*				
Iron	*0.5*	*0.14*	*--*				
HSC	*30.0*	*24.5*	*--*				
Oil Products	*0.05*	*0.07*	*--*				
SPAR	*0.1*	*0.15*	*--*				
Phenols	*0.001*	*0.005*	*--*				

Work program of the discipline (syllabus):

Compiled *prof., Doctor of Technical Sciences, Shabliy T.O., Assoc., Ph.D., Sirenko L.V.*

Approved *by the* ***Ecology and technology of plant polymers*** *(protocol No 14 from 18.05.2023)*

Approved *by the CEF Methodical Commission (protocol No.10 of 26.05.2023)*