



### Coursework in Waste Management

#### Work program of the discipline (Syllabus)

##### Details of the discipline

Level of higher education	<i>Second (master's)</i>
Field of knowledge	<i>10 Natural sciences</i>
Speciality	<i>101 Ecology</i>
Educational program	<i>Environmental safety</i>
Discipline status	<i>Required</i>
Form of study	<i>full-time (day)/remote/mixed</i>
Year of preparation, semester	<i>1st year, autumn semester</i>
Scope of discipline	<i>1 ECTS credit (30 hours)</i>
Semester control/control measures	<i>Test</i>
Schedule of classes	<i>-</i>
Language of instruction	<i>Ukrainian</i>
Information about the course / teachers	Consultant: <a href="https://eco-paper.kpi.ua/pro-kafedru/vykladachi/vizytyky/radovenchik-vyacheslav-mikhajlovich.html">https://eco-paper.kpi.ua/pro-kafedru/vykladachi/vizytyky/radovenchik-vyacheslav-mikhajlovich.html</a>
Course placement	<a href="https://do.ipk.kpi.ua/course/view.php?id=3364">https://do.ipk.kpi.ua/course/view.php?id=3364</a>

##### The program of the discipline

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

*Solid household waste has always been formed as a result of human life processes. Since in the early stages of the development of human society it used and consumed only products of natural origin and lived dispersedly, solid waste did not bother him much. The simplest small volumes of such waste could be eliminated by incineration or disposal. Intensive urbanization and the use of a significant amount of artificial substances began to exacerbate the problem of solid household waste. The first problems of solid household waste were large-scale epidemics caused by their pre-carriers, which multiplied en masse in piles of garbage – rats, bedbugs, fleas, etc. with an increase in the volume of solid household waste accumulation, problems began to arise with odors and smoke in the surrounding areas during self-ignition of landfills. how their negative impact was further exacerbated.*

*Today, the use of a significant amount of substances and materials that are not typical for the environment, such as nutrients, household chemicals, unsuitable medicines and medications, worn-out household appliances, etc. have led to pollution of the main components of the environment - soils, air, surface and groundwater. garbage.*

*The resource saving factor is becoming increasingly important in the problems of solid household waste, since the composition of waste changes significantly and they can go into the category of man-made deposits in individual components, and the economic factor, since waste recycling can, in some cases, bring quite significant profits.*

*The subject of the discipline "Coursework in Waste Management" – the implementation of technical and technological approaches that guarantee a stable and safe protection of mankind from the negative effects of solid household waste.*

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

*To successfully solve the problems of protecting and preserving the environment while ensuring the stable development of mankind, specialists must be fluent in information, be able to solve complex problems of protecting the environment from pollution at the highest technological and scientific level.*

### ***The purpose of the discipline "Coursework in Waste Management"***

*The purpose of studying this discipline is to form in the masters a set of knowledge in the field of modern technologies for the collection, transportation, processing and disposal of solid household waste, scientific developments in the field of increasing the efficiency of the use of natural material and energy resources, a set of skills and abilities necessary for the introduction into production and management of modern and new we are the method of solid waste management and technology, the creation of effective systems for their disposal and storage.*

- *Ability to organize work related to environmental assessment, environmental protection and environmental optimization, in conditions of incomplete information and conflicting requirements. **C 15.***

- *Ability to self-education and advanced training based on innovative approaches in the field of ecology, environmental protection and balanced environmental management. **C 16.***

- *Ability to independently develop environmental projects through the creative application of existing and generating new ideas. **C 17.***

- *Ability to assess the level of negative impact of natural and anthropogenic factors of environmental hazard on the environment and humans. **C 18.***

- *The ability to develop a complex of management solutions. **C 19.***

*According to the requirements of the program of the discipline "Coursework in Waste Management", after mastering it, students must demonstrate the following programmatic learning outcomes:*

- *Be able to communicate in a foreign language in the scientific, industrial and socio-social spheres of activity. **PO 07.***

- *Demonstrate awareness of the latest principles and methods of environmental protection. **PO 10.***

- *Be able to use modern information resources on ecology, environmental management and environmental protection. **PO 11.***

- *To be able to assess landscape and biological diversity and analyze the effects of anthropogenic impact on the environment. **PO 12.***

- *Be able to assess the potential impact of technogenic facilities and economic activities on the environment. **PO 13.***

- *Apply new approaches to develop a decision-making strategy in difficult unpredictable conditions. **PO 14.***

- *Assess environmental risks in the face of insufficient information and conflicting requirements. **PO 15.***

- *Choose the optimal strategy of management and / or environmental management depending on environmental conditions. **PO 16.***

- *To master the basics of ecological engineering design and expert environmental impact assessment. **PO 20.***

- *Using scientific and technical information, regulatory documents, professional knowledge, apply methods of managing technological processes, equipment that protect water bodies, atmosphere, soils and subsoil from pollution and harmful effects. **PO 23.***

## 2. Prerequisites and post-requisitions of disciplines (place in the structural and logical scheme of education according to the relevant educational program)

Study of the discipline "**Coursework in Waste Management**" is based on the principles of integration of various knowledge gained by students during their studies in bachelor. Discipline "**Coursework in Waste Management**" provides internship, as well as the implementation of master's work.

## 3. Schedule of course work

Semester Week	The name of the stage of work	IWS study time
1	Obtaining a task for the course work "Selection of the territory and calculation of the parameters of the landfill". Selection and study of literature	4
2	The choice of the block diagram of the polygon, the calculation of the area of the site	6
3	Design of the warehousing site	5
4	Forecast of the man-made impact of the landfill waste on the components of the natural environment.	3
5	Selection and calculation of the protective screen of the polygon.	3
6	Calculation of internal drainage and filtrate removal system.	6
7	Calculation of the polygon degassing system.	2
8	Submission of coursework for review	0,5
9	Defense of course work	0,5
	Just:	30

## 4. Learning materials and resources

### Basic literature

1. Radovenchyk V.M., Gomel M.D. *Solid waste: collection, processing, warehousing*. – Kyiv: Condor, 2010. – 549 p.
2. Law of Ukraine "On Waste", No. 187/98 – Verkhovna Rada of March 5, 1998
3. Radovenchyk V.M., Poberezhnyi M.V., Radovenchyk Y.V., Kutsak K.A. Peculiarities of solid waste management on the territory of Ukraine // *Municipal economy of cities*, 2019. – issue. 147. – vol. 1. – P. 94 – 100. DOI 10.33042/2522-1809-2019-1-147-94-100.
4. Radovenchyk V.M., Poberezhnyi M.V., Radovenchyk Y.V., Krysenko T.V. Disposal of solid household waste on the territory of Ukraine in 2018 // *Municipal economy of cities*, 2019. – issue. 152. – vol. 6. – P. 67 – 72. DOI 10.33042/2522-1809-2019-6-152-67-72.
5. *Waste management and management. Part 2. Solid household waste: textbook* / Petruk V.G., Vasylykivsky I.V., Kvaternyuk S.M. et al. – Vinnytsia: VNTU, 2015. – 100 p.

### Further reading

1. *Waste management and management: Textbook* / T.P. Shanina, O.R. Gubanova, M.O. Klimenko, T.A. Safranov, V.Y. Korinevskaya, O.O. Bedunkova, A.I. Volkov. Ed. T.A.Safranova, M.O. Klymenko, - Odessa: ODEU, 2011. □□258 p.
2. *Best European Practices in Waste Management (Guide)* / A. VoyTsikhovska, O. Kravchenko, O. Melen-Zabramna, M. Pankevych, [edited by O. Kravchenko] — Publishing House Company "Manuscript" — Lviv, 2019. — 64 p.
3. *Norms of solid waste generation for settlements of Ukraine*. – Order of the Ministry of Construction of Ukraine No7 of 10.01.06 – 14 p.
4. *DBN V.2.4. – 2005. Solid waste landfills. Fundamentals of design*. – K., 2006. – 35 p.

## **Information resources on the Internet**

1. Ministry of Environmental Protection and Natural Resources in Ukraine - <https://mepr.gov.ua>.
2. Industrial Ecology. Community of Environmental Specialists - <http://www.eco.com.ua/>
3. Professional Association of Ecologists of Ukraine (PAEU) - <https://paeu.com.ua>.
4. Ministry for Communities and Territories Development - <https://www.minregion.gov.ua>.
5. Communal enterprise "Kyivkomunservice" - <https://kks.kiev.ua>.

## **Educational content**

### **5. Methods of mastering the discipline (educational component)**

*Course work consists of seven tasks that involve either making calculations to obtain specific characteristics of the necessary equipment and the system as a whole, or selecting equipment according to known calculated parameters.*

*Practical assimilation of the discipline is achieved both by purposeful selection of the topics of individual lessons, and by organizing the process of performing course work.*

*Course work is performed on an individual task and drawn up in the form of an explanatory note.*

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

1. *Tasks for the course work.*
2. *Detailed description of the solution process.*
3. *The results of calculations and their analysis (numerical, graphic, tabular value of the calculation results).*
4. *Conclusions on each division of work, on the work as a whole in terms of recommendations for further measures to protect the environment.*
5. *References.*

### **6. Independent work of the student**

*Independent work of students takes 100 % of the time to study this course, also includes preparation for the test. analyze the problem of solid waste management and, on the basis of calculations, come to their own reasonable conclusions about the effectiveness of the selected methods of their disposal.*

## **Policy and control**

### **7. Policy of the discipline (educational component)**

#### **The ethics of deadlines and rescheduling**

*In case of debts in the discipline or any force majeure circumstances, students should contact the teacher through the available (provided by the teacher) communication channels to solve 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 links when using printed and electronic materials, quotes, opinions of other authors. Unacceptable hints and write-offs when writing tests, conducting classes; passing the exam for another student; copying materials protected by the copyright system without the permission of the author of the work.*

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

#### **Academic Conduct and Ethics Policy**

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

*The norms of ethical behavior of students and employees are defined in Chapter 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 evaluating learning outcomes (RSO)

*Distribution of study time by types of classes and tasks in the discipline in accordance with the working curriculum:*

Semester	Study time		Distribution of study hours				Control measures		
	Loans	acad. H.	Lecture	Practical	Lab. Rob.	IWS	MCT	HCW	Semester control
1	1	30	-	-	-	30	-	-	Test

*The rating assessment of the course work has two components. The first (starting) characterizes the student's performance of the course work and its result – the quality of the explanatory note.*

### **Rating points system**

*1. The starting component ( $r_1$ ) has two parts. The first part ( $r_{11}$ ) concerns the implementation of the first section of the course work, the component ( $r_{12}$ ) – the second section.*

- timeliness of the relevant part of the course work - 12-8 points;*
- correctness of application of calculation methods, qualitative and quantitative assessment of the results obtained – 14–10 points;*
- justification of recommendations for further measures to protect the environment - 16-9 points.*
- quality of design 8-3 points.*

*2. The component of the defense of the course work ( $r_2$ ) accordingly incorporates two parts ( $r_{21}$ ) and ( $r_{22}$ ), each of which is evaluated:*

- degree of possession of the material 16–9 points;*
- the degree of justification of the decisions made and the correctness of the conclusions 25-17 points;*
- ability to defend one's opinion 9–4 points.*

*The sum of the points of the two components is transferred to the test score according to the table:*

### *Rating scale in the discipline*

$R = r_1 + r_2 + r_3 + r_4$	University scale
95... 100 points	Perfectly
85... 94 points	Very good
75...84 points	Well
65... 74 points	Satisfactory
60...64 points	Enough
$R < 60$ points	Disappointing
<i>If <math>r_c &lt; 40</math> points or other conditions are not met, the coursework is not allowed to be protected</i>	Not allowed

## 9. Additional information on the discipline (educational component)

### Initial data for the course work

<i>Variant</i>	<i>Service life</i>	<i>Population, yew. Persons.</i>				<i>Plant layer thickness</i>	<i>Construction area</i>		
		<i>H<sub>1</sub></i>	<i>H<sub>2</sub></i>	<i>H<sub>3</sub></i>	<i>H<sub>4</sub></i>		<i>Precipitation mm</i>	<i>Evaporation from the water surface, mm</i>	
<i>N<sub>0</sub></i>	<i>T</i>	<i>H<sub>1</sub></i>	<i>H<sub>2</sub></i>	<i>H<sub>3</sub></i>	<i>H<sub>4</sub></i>	<i>h<sub>p</sub></i>	<i>O</i>	<i>E</i>	
1	10	45	67	33	74	0,2	680	356	Odessa
2	12	47	64	37	85	0,25	815	241	Kherson
3	14	49	61	41	96	0,15	770	510	Mykolayivska
4	16	51	58	45	107	0,2	640	258	Kyivska
5	18	53	55	49	118	0,3	770	501	Zaporizhia
6	20	55	52	53	129	0,3	770	548	Dnipropetrovs'k
7	22	57	49	57	140	0,2	710	404	Donetsk
8	24	59	46	61	128	0,25	745	370	Lugansk
9	10	61	43	65	116	0,2	720	561	Rivne
10	12	63	40	62	104	0,25	694	543	Volynska
11	14	65	37	59	89	0,15	710	543	Ternopil'ska
12	16	67	34	56	74	0,2	737	515	Lviv
13	18	69	36	53	59	0,3	702	526	Zakarpattia
14	20	71	38	50	65	0,3	747	511	Sumska
15	22	73	40	47	71	0,2	687	457	Ivano-Frankivsk
16	24	75	42	44	77	0,25	68	492	Chernivtsi
17	10	77	44	41	83	0,2	583	447	Chernihiv'ska
18	12	79	46	38	89	0,25	750	535	Kirovohrad'ska
19	14	81	48	35	95	0,15	636	471	Kharkiv'ska
20	16	83	50	32	101	0,2	733	508	Crimea AR
21	18	85	52	29	107	0,3	700	550	Khmelnitsky
22	20	87	54	45	113	0,3	695	533	Vinnitska
23	22	89	56	61	119	0,2	610	494	Zhytomyr'ska
24	24	91	58	77	125	0,25	660	541	Poltava
25	10	93	60	93	131	0,3	631	453	Lugansk
26	12	95	62	109	125	0,3	590	441	Rivne
27	14	97	64	125	119	0,2	744	432	Volynska
28	16	99	66	78	113	0,25	680	492	Ternopil'ska
29	18	101	68	31	107	0,2	631	453	Lviv
30	20	103	70	45	101	0,25	737	515	Zakarpattia
31	22	105	72	59	95	0,15	702	526	Sumska
32	24	107	74	73	89	0,2	747	511	Ivano-Frankivsk
33	20	109	76	87	83	0,3	687	457	Chernivtsi

## Hydrogeological conditions of the landfill construction area

<i>Variant</i>	<i>Type of soil at the base of the floor and rut</i>	<i>Filtration coefficient (<math>K_f</math>), m/s</i>	<i>H of groundwater, <math>h_{gr}</math>, m</i>
1	sand	1,0	6,3
2	Sandy loam	0,5	5,1
3	Loam light	0,15	6,2
4	Loam heavy	0,012	5,0
5	sand	1,1	5,3
6	Sandy loam	0,45	5,0
7	Loam light	0,2	4,6
8	Loam heavy	0,015	5,6
9	clay	0,036	6,0
10	sand	1,1	4,7
11	Sandy loam	0,6	5,7
12	Loam light	0,2	4,0
13	Loam heavy	0,015	3,3
14	clay	0,036	5,0
15	sand	1,1	4,6
16	Sandy loam	0,6	5,6
17	Loam light	0,2	6,0
18	Loam heavy	0,015	4,7
19	clay	0,036	3,7
20	sand	1,1	5,2
21	Sandy loam	0,6	4,6
22	Loam light	0,2	6,6
23	Loam heavy	0,015	6,0
24	clay	0,036	4,7
25	sand	1,1	3,7
26	Sandy loam	0,6	5,2
27	Loam light	0,2	5,0
28	Loam heavy	0,015	6,3
29	clay	0,036	5,0
30	sand	1,1	4,6
31	Sandy loam	0,6	6,6
32	Loam light	0,2	6,0
33	Loam heavy	0,015	5,7

**Work program of the discipline (syllabus):**

**Compiled** prof., Doctor of Technical Sciences, Radovenchik V.M.

**Approved** by the Department \_\_\_E and PPT\_\_\_ (protocol No. 14 of 8.06.2022)

**Approved** by the FCE Methodical Commission (Protocol No. 10 of 24.06.2022)