MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
ODESSA STATE ENVIRONMENTAL UNIVERSITY

«APPROVED»
at the session of the group for
specialization assurance
on "15" 05 2023
Protocol No. 8
Chairman of the group Chugai A.V.

«ALIGNED»
at the meeting of the Department of
Ecology and environmental protection
on "4" 05 2023
Protocol No. 8
Head of the department Safranov T.A.

SYLLABUS

of the course
«WASTE MANAGEMENT »

(course name)

101 «Ecology»

(code and name of specialization)

Bachelor			Full-time
(higher education level)			(form of study)
IV	VIII	3/90	test
(year of study)	(semester of study)	(ECTS credits/hours)	(form of assessment)

Department of Ecology and Environmental Protection

(department)

Odesa, 2023

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Lecturer: Lecturs: Mykhailenko V.I., assistant of the Department of Ecology and Environmental Protection, PhD (Ecology)_____
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Reviewer: Chugai A.V. – Dean of the Faculty of Environmental Protection, Doctor of Technical Sciences, Professor

List of previous editions

Surnames and initials of authors	Date, protocol number	Effective date

1. COURSE DESCRIPTION

Goal	Building knowledge in the field of waste management and treatment, existing and prospective technologies for managing production and consumption waste, which make it possible to solve environmental problems and fix the consequences of waste disposal in the environment
Competence	C40. Ability to evaluate the level of ecological security
Learning outcomes	P0404. Ability to develop a set of measures for production and consumption waste management
Basic knowledge	1) Understanding of the basic conceptual and terminological framework, as well as legal and regulatory framework in regard to waste; 2) Understanding of the waste management system. Knowledge of the basic methods and tools for waste management; 3) Knowledge of the requirements for basic waste handling operations, core understanding of waste preparation and processing methods; 4) Understanding of the main methods of industrial waste disposal and treatment; 5) Concept of municipal solid waste, the organization of collection and transportation of such waste; 6) Knowledge of the main management methods for municipal solid waste. Understanding of the environmental consequences of burying and incineration of these wastes.
Theoretical skills	1) Applying the acquired knowledge in the development of a set of measures for managing and handling production and consumption/consumer waste. Specifically, ability to propose an optimal way of administering any kind of waste based on existing legislation; 2) Determining the characteristics of waste and their impact on the environment.
Practical skills	1) Using the principle of priority (International hierarchy of waste management methods) when developing waste management and disposal systems for industrial and municipal waste.
Connected syllabuses	-
Previous courses	«Chemistry with Fundamentals of Biogeochemistry», «General ecology and Neoecology», «Physic», «Environmental Monitoring», «Technical Ecology».
Next courses	«Modern technologies of environmental protection».
Hours	lectures: 27 hours practical classes: 18 hours Individual student work (ISW): 45 hours

2. COURSE OUTLINE

2.1. Lectures

Code	Module name	Hours	
		auditorium	ISW
M-L1	**General concepts of waste management and disposal, handling of solid industrial waste.** • Topic 1. Regulatory framework on waste issues. Principles of waste classification. Waste management and disposal system in Ukraine. • Topic 2. Methods and tools for waste management. • Topic 3. Waste management and disposal system in EU countries: best practices. European legislation on waste issues. • Topic 4. Basic requirements for waste operations. Methods of preparation and processing of solid waste. • Topic 5. Industrial waste disposal.	3 2 2 3 3	2 2 2 2 2
	Test 1	13	10
M-L2	**Municipal solid waste management** • Topic 1. The problem of municipal solid waste in Ukraine. Properties of solid household waste. Formation and accumulation of municipal solid waste. • Topic 2. Organization of collection and transportation of municipal solid waste. • Topic 3. Disposal methods for solid household waste. • Topic 4. Utilization methods for solid household waste. • Topic 5. The concept of municipal solid waste management developed in OSENU. Separate collection and utilization of individual components of municipal solid waste	4 2 3 3 2	2,5 2 2 2 2
	Test 2	14	10,5
	Total	**27**	**20,5**

Consultations: Mykhailenko V.I., once a week for 1 hour (14:00-15:00, Monday) according to the schedule of consultations approved at the department meeting.

2.2. Practical components

Code	Module and topics	Hours	
		auditorium	IWS
M-P1	**Performing calculations using regulatory methods.** • Topic 1. Calculation of waste generation standards for categories A and B. • Topic 2. Calculation of waste generation standards for category C • Topic 3. Calculation of waste generation standards for categories G and D • Topic 4. Calculation of environmental damage caused by waste disposal on land of different qualities. Oral examination. Defense of practical work.	3 3 3 9	5 5 5 6,5
	Total:	18	19,5

Consultations: Mykhailenko V.I., once a week for 1 hour (14:00-15:00, Monday) according to the schedule of consultations approved at the department meeting.

2.3. Individual student work and control measures.

Module code	Tasks on ISW and control measures	Hours, ISW	Period of implementation (semester, week)
II semester			
M-L1	Preparation for lectures (mandatory) Preparation for the modular/module-based test (mandatory)	10	II semester, 9 week
M-L2	Preparation for lectures (mandatory) Preparation for the modular/module-based test (mandatory)	10,5	II semester, 9 week
M-P1	Preparation for practical classes (mandatory)	19,5	II semester, 4 week
	Preparation for the test	5	I semester, 9 week
	Total:	45	

2.3.1 Methods of conducting and evaluating the control measure for M-L1, M-L2.

The organization of student knowledge assessment is based on the cumulative-module principle in accordance with the requirements of the current university regulation «On conducting final assessment of student knowledge».

Regarding the *theoretical course* of the academic discipline, the student should be prepared to answer oral questions from the lecturer during lectures and complete module-based tests for the material covered in substantial lecture modules - M-L1, M-L2.

Module-based tests contain 10 multiple-choice questions. Each correct answer is evaluated at 2.5 points. The maximum number of points for completing each module-based test is 25 points. The maximum number of points a student can receive for the lecture part is 50 points.

2.3.2. Methodology for conducting and evaluating the control event for M-P1.

The form of control for the practical module M-P1 is an oral examination during practical classes and defense of practical work. Practical works №1, №2 are evaluated based on the results of defense, a maximum of 25 points each. Therefore, a student can receive a total of 50 points for practical classes.

The maximum total score for the discipline «Waste Management» that a student can receive is 100 points.

Students who have a debt in the practical part of the course on the first day of the examination session are not allowed to take the final semester exam until the debt is cleared in accordance with the schedule approved by the teachers of the discipline, approved by its head, and published for students on the last day of the semester.

Students who have cleared the debt in the practical part of the course during the examination session are allowed to take the test and must complete the test tasks developed for the discipline «Waste Management» within the deadline set by the test schedule according to the OSENU educational part order on exam schedule.

The test tasks (final control) contain 20 questions in a test format. Each correct answer is worth 1 point, and there is no negative marking.

Results of a written exam are recorded as a quantitative score (grade) in the academic record of the established form. Then the teacher averages the quantitative score of the current control measures and the quantitative score of the semester control measure and assigns a general quantitative score (overall grade) on a 4-point quality scale and an "F" grade on a 7-point ECTS scale.

If a student receives a general quantitative score of less than 50% (out of the maximum possible on the exam), the teacher assigns an "FX" grade on the ECTS scale and a "fail" grade on the 4-point quality scale, regardless of the student's total quantitative score. Such students have the opportunity to work towards admission to the exam and pass it according to the established procedure in OSENU within the framework of eliminating debts by the final certification commission.

3. RECOMMENDATIONS FOR INDIVIDUAL STUDENT WORK

3.1. Module M-L1 «General concepts of waste management and treatment, solid industrial waste management»

3.1.1. Learning

Topic 1. Regulatory and legal framework on waste management. Principles of waste classification. Waste management and handling system in Ukraine.

When studying this topic, special attention should be paid to the basic terms and definitions related to waste (waste, waste management, disposal, utilization, neutralization, hazardous waste, etc.). Emphasis should be placed on issues such as the hazard class of waste and its determination, the "color" classification of waste, the State Classifier of Waste DK 005-96, as well as the levels of waste management system and the powers of waste management entities.

Literature: [1, 2].

Topic 2. Methods and tools of waste management.

When studying this topic, special attention should be paid to the following issues: administrative, economic, and informational methods of management and their practical implementation in Ukraine.

Literature: [1, 2, 8, 10].

Topic 3. Waste management and handling system in European Union countries: best practices. European legislation on waste.

When studying the topic, pay special attention to such issues as the international hierarchy of waste management methods, classification of EU Directives on waste, circular economy.

Literature [1, 2].

Topic 4. Basic requirements for waste operations. Methods of preparation and processing of solid waste.

When studying the topic, pay special attention to such issues as requirements for waste collection and transportation, waste passport, list of waste disposal operations. Know the classification of methods for preparing and processing waste.

Literature [1, 2, 3, 6, 7, 10-12].

Topic 5. Industrial waste disposal.

When studying the topic, pay special attention to such issues as disposal of plastic waste, mining and extraction industry waste, and industrial waste that is not subject to disposal.

Literature [1, 2, 3, 6, 9-12].

3.1.2. Self-check questions

1. What are waste?
2. What is waste management?
3. What does waste disposal and removal mean?
4. What is waste placement?
5. What is waste burial?
6. What are the objects of waste management?
7. Classification of waste.
8. Classification of waste by place of origin.
9. Classification of waste by industry sectors and types of enterprise activities.
10. Classification of waste by aggregate state.
11. Waste hazard classes.

12. Waste classification developed by the Institute of Environmental Problems (Kharkiv).
13. "Color classification" of waste.
14. Waste code structure.
15. What is "waste management"?
16. Waste management methods and their classification.
17. Administrative tools for waste management.
18. Economic instruments for waste management.
19. Information tools for waste management.
20. Structure of waste management system.
21. Regulatory and legal framework in the field of waste management.
22. EU legislation in the field of waste management.
23. International hierarchy of waste management methods.
24. Basic requirements for waste collection.
25. Requirements for waste transportation.
26. What is waste treatment?
27. Classification of methods for waste preparation and processing.
28. Main directions of waste disposal.
29. Waste disposal.
30. Priority directions for waste management in production.
31. Coefficients of changes in the physical state and chemical composition of waste.
32. Indicator of the economic efficiency of waste processing methods.
33. Coefficient of territory alienation.
34. Coefficient of useful use of waste.
35. What are the main directions for waste disposal in the fuel and energy complex?
36. What are the main directions for waste disposal in the mining and metallurgical complex?
37. What are the peculiarities of plastic waste disposal?
38. What are the peculiarities of organizing the burial of industrial waste that is not disposed of at the "Chervonyi Bor" landfill?

Self-check questions of basic knowledge results

1. What is waste?
2. What is waste management?
3. Classification of waste.
4. Structure of waste code.
5. What is "waste management"?
6. Methods of waste management and their classification.
7. Regulatory framework in the field of waste management.
8. EU legislation in the field of waste management.
9. Requirements for the transportation of waste.
10. Classification of methods for the preparation and processing of waste.
11. Main directions of waste disposal.
12. Coefficient of useful use of waste.
13. What are the main directions of waste disposal in the fuel and energy complex?
14. What are the main directions of waste disposal in the mining and metallurgical complex?
15. What are the peculiarities of plastic waste disposal?

3.2. Module M-L2 «Municipal Solid Waste Management»

3.2.1. Learning

Topic 1. The problem of MSW in Ukraine. Properties of Municipal Solid Waste. Formation and accumulation of MSW.

When studying the topic, special attention should be paid to the following issues: the current state of the MSW management sector (based on data from the Ministry of Regional Development), the morphological composition and properties of MSW, determining the quantitative characteristics of MSW formation, and the legislative and regulatory framework on MSW management**.**

Literature [1, 2, 3, 4, 9, 11].

Topic 2. Organization of MSW collection and disposal.

When studying the topic, special attention should be paid to the following issues: organization of separate collection of MSW, scheme of sanitary cleaning of settlements, formation of tariffs for services related to MSW management.

Literature [1, 2, 3, 4, 8, 9, 10, 11].

Topic 3. Methods of MSW disposal.

When studying the topic, special attention should be paid to the following issues: organizational and technical aspects of MSW burial at landfills, environmental protection at MSW landfills, environmental consequences of MSW burial, thermal methods of MSW treatment, and their environmental consequences.

Literature [1, 2, 3, 4, 9, 10, 12].

Topic 4. Methods of MSW utilization.

When studying the topic, special attention should be paid to the following issues: composting technologies, vermicomposting, anaerobic digestion of waste.

Literature [1, 2, 3, 4, 7, 8, 9, 10].

Topic 5. The concept of MSW management developed at OSENU. Separate collection and utilization of individual components of MSW.

When studying the topic, special attention should be paid to the following issues: the principle of differentiation of MSW, management of individual components of the overall waste stream, features of collection and utilization of valuable resources in MSW (paper, plastic waste), hazardous waste in MSW.

Literature [2, 3, 11, 13].

3.2.2. Self-check questions

1. What is Municipal Solid Waste?
2. Morphological composition of Municipal Solid Waste.
3. Factors affecting the morphological composition of Municipal Solid Waste.
4. Fractional composition of Municipal Solid Waste.
5. Chemical composition of Municipal Solid Waste.
6. Moisture and density of Municipal Solid Waste.
7. Physical properties of Municipal Solid Waste.
8. Sanitary and epidemiological properties of Municipal Solid Waste.
9. What is the norm for accumulation of Municipal Solid Waste?

10. Factors affecting the norm for accumulation of Municipal Solid Waste.
11. Current state of Municipal Solid Waste management in Ukraine.
12. Types of Municipal Solid Waste collection.
13. Organization of Municipal Solid Waste removal.
14. Requirements for the organization of Municipal Solid Waste container sites.
15. Organization of separate collection of Municipal Solid Waste according to scheme №1.
16. Organization of separate collection of MSW according to scheme № 2.
17. Organization of separate collection of MSW according to scheme № 3.
18. Organization of separate collection of MSW according to scheme № 4.
19. Waste transfer stations and their advantages.
20. Main methods of handling MSW.
21. Impact of MSW landfills on the atmosphere.
22. Formation of leachate in the body of MSW landfills.
23. Organization of protection of water supply systems at MSW landfills.
24. Advantages and disadvantages of waste incineration.
25. Pyrolysis of MSW.
26. Gasification of MSW.
27. Main methods of obtaining compost.
28. Problems of composting MSW in Ukraine.
29. Vermicomposting of MSW.
30. Concept of MSW management developed in OSENU.
31. Utilization of waste paper.
32. Types of plastics and peculiarities of their utilization.

Self-check questions of basic knowledge results

1. What is Municipal Solid Waste (MSW)?
2. Fractional composition of MSW.
3. Chemical composition of MSW.
4. Sanitary and epidemiological properties of MSW.
5. What is the norm for accumulation of MSW?
6. The current state of MSW management in Ukraine.
7. Types of MSW collection.
8. Requirements for organizing container sites for MSW.
9. Main methods of handling MSW.
10. Organization of protection of water supply systems at MSW landfills.
11. Advantages and disadvantages of waste incineration.
12. Problems of composting MSW in Ukraine.
13. The concept of MSW management developed in OSENU.
14. Utilization of waste paper.
15. Types of plastic and peculiarities of their utilization.

4. QUESTIONS FOR CURRENT, FINAL, AND MIDTERM ASSESSMENTS

4.1. Questions for final assessment of lecture modules:

4.1.1 Module control questions for M-L1

1. What is waste management? [2, p. 22]
2. Classification of waste by place of origin [2, p. 24]
3. Structure of waste codes [2, pp. 28-31].
4. Economic efficiency indicator of waste processing methods [2, pp. 73-75].
5. Recycling of thermoplastic plastics [2, pp. 114-116].
6. What waste is included in the Green List? [2, p. 27].
7. What are the main regulatory documents in the field of waste management in Ukraine? [2, pp. 31-34].
8. Administrative instruments for waste management [2, pp. 45-46].
9. Basic requirements for the collection of industrial waste [2, pp. 87-88].
10. Coefficient of useful utilization of waste [2, p. 75].
11. What is waste? [2, p. 22]
12. Classification of waste by place of origin [2, p. 24].
13. Hazard classes of waste [2, pp. 25-26].
14. Waste disposal [2, p. 23].
15. Economic efficiency indicator of waste processing methods [2, p. 74].
16. What is waste management? [2, p. 22].
17. Classification of waste by industry and type of enterprise activity [2, p. 24].
18. General structure of state management of waste [2, pp. 36-40].
19. Regulatory and legislative framework in the field of waste management [2, pp. 31-34].
20. Treatment of industrial waste [2, pp. 91-92].
21. What does waste disposal and removal mean? [2, p. 23].
22. Classification of waste by aggregate state [2, p. 25].
23. Economic instruments for waste management [2, p. 45].
24. What is waste treatment? [2, pp. 91-92].
25. Handling of waste in the mining industry [2, pp. 105-106].
26. What does waste burial mean? [2, p. 23].
27. «Color classification» of waste [2, pp. 26-27].
28. Administrative instruments for waste management [2, pp. 46-47].
29. International hierarchy of waste management methods [2, pp. 77-78].
30. Coefficients of changes in the physical state and chemical composition of waste [2, p. 74].
31. What falls under the category of waste management objects? [2, p. 23].
32. What is «waste management»? [2, p. 44].
33. Informational instruments for waste management [2, pp. 65-67].
34. Basic levels of waste management systems [2, pp. 36-40].
35. EU legislation on waste [2, pp. 76-77].
36. Classification of waste [2, p. 23].
37. Requirements for transporting industrial waste [2, pp. 83-91].
38. Methods of waste size reduction [2, pp. 99-100].

39. Coefficient of useful utilization of waste [2, p. 75].
40. Utilization of thermoreactive plastics [2, pp. 114-116].
41. Regulatory framework for waste management in Ukraine [2, pp. 114-116].
42. Requirements for waste storage [2, p. 88].
43. Methods of waste size reduction [2, pp. 99-100].
44. Priority directions for handling waste in production [2, p. 74].
45. Coefficients of changes in the physical state and chemical composition of waste [2, p. 74].
46. Mechanisms of waste management [2, pp. 44-45].
47. Classification of methods for preparing and processing waste [2, pp. 96-101].
48. Advantages and disadvantages of economic instruments for waste management [2, p. 69].
49. Regulations for waste generation [2, p. 49].
50. Waste inventory [2, p. 53].

4.1.2 Module control questions for M-L2

1. What are municipal solid waste? [2, p. 133].
2. Physical properties of MSW [2, pp. 138-139].
3. Organization of separate collection of MSW according to scheme № 1 [2, pp. 150-151].
4. The concept of municipal solid waste management developed in OSENU [2, pp. 208-212].
5. What is the morphological composition of MSW? [2, pp. 135-136].
6. Which factors influence the morphological composition of MSW? [2, p. 136].
7. Types of MSW collection [2, p.146].
8. Organization of separate collection of MSW according to scheme № 2 [2, p. 151].
9. Protection of the environment and human health at MSW landfills [2, p. 207].
10. Management of easily degradable organic waste [2, pp. 209-219].
11. Morphological composition of MSW [2, p. 135-136].
12. What is the norm for accumulation of MSW? [2, p. 142].
13. Organization of separate collection of MSW according to scheme № 3 [2, p. 151-152].
14. Basic methods of MSW management [2, p. 157].
15. Main drawbacks of MSW incineration [2, p. 181].
16. Physical properties of MSW [2, p. 138-139].
17. What does the system of MSW collection and removal include? [2, p. 141].
18. Organization of separate collection of MSW according to scheme № 4 [2, p. 152].
19. Essence of pyrolysis of MSW [2, p. 187-188].
20. Features of composting the organic component of MSW [2, p. 189].
21. Sanitary-epidemiological properties of MSW [2, p. 140-142].
22. Organization of MSW removal [2, p. 140-142].
23. Essence of vermicomposting method [2, p. 198-205].
24. Main stages of anaerobic biochemical processes at MSW landfill [2, p. 160].
25. What are municipal solid wastes (MSW)? [2, p. 133].
26. Within what period do the maximum volumes of biogas form at the MSW landfill? [2, p. 162].

27. Factors that influence the norm for accumulation of MSW [2, p. 142].
28. When is the non-container method of MSW collection used? [2, p. 146].
29. Main methods of obtaining compost [2, p. 189-192].
30. When is it expedient to use waste transfer stations? [2, p. 154].
31. Current state of landfilling and disposal of MSW [2, p. 150].
32. Which waste in the MSW stream is classified as bulky waste? [2, p. 147].
33. What are the main stages of biogas formation in a landfill body? [2, p. 160].
34. What is the name of the thermochemical decomposition of the organic component of MSW into gaseous products under incomplete oxidation? [2, p. 188].
35. What is the timeframe for obtaining biogas from MSW landfill? [2, p. 162].
36. What is the term used for the content of individual components of MSW, expressed as a percentage of the total waste mass? [2, p. 135-136]
37. What is the term used for the places or objects used for the collection, storage, processing, disposal, treatment, and burial of MSW? [2, p. 23]
38. What is the timeframe for generating biogas through the biological decomposition of organic components of MSW? [2, p. 160]
39. What useful product is obtained through vermicomposting? [2, p. 198]
40. Which methods of MSW management primarily address sanitary and hygiene issues? [2, p. 157].
41. What is the term used for the type of hazardous waste that, upon entering the body through the respiratory, digestive, or skin organs, exerts a toxic effect and can cause prolonged or chronic illnesses? [2, p. 22]
42. What are the drawbacks of landfilling MSW on landfills and disposal sites? [2, p. 157].
43. What is the purpose of using waste transfer stations? [2, p. 155].
44. What gas is obtained through anaerobic fermentation of organic waste? [2, p. 160].
45. Which methods of MSW management primarily address economic issues - the use of secondary resources? [2, p. 157].
46. What is the norm for accumulation of hazardous waste? [2, p. 142]
47. What level of waste management do commodity exchanges, environmental protection funds, and public organizations belong to? [2, p. 40]
48. What is the term for the activity associated with the removal, accumulation, and disposal of waste in specially designated places or facilities, including waste sorting for further utilization or disposal? [2, p. 22]
49. What is the term for a one-time set of organizational and technical measures for identifying, identifying, describing, and registering waste, accounting for the volumes of their formation, etc.? [2, p. 53]
50. What category of waste does electronic and electrical equipment waste belong to in MSW? [2, p. 209].

4.2. Questions for the final assessment of practical module learning outcomes.

4.2.1. Questions for the final assessment of M-P1

Topic 1. Calculation of waste generation standards for categories A and B.

1. Which wastes are classified as category A?
2. Which wastes are classified as category B?

3. What is a waste generation standard?
4. How is the waste generation standard calculated per unit of raw material?
5. How is the waste generation standard calculated per unit of production?
6. Provide examples of wastes corresponding to each category.

Literature [1, 2]

Topic 2. Calculation of waste generation standards for category B.

1. Which wastes are classified as category B?
2. What is a waste generation standard?
3. How is the waste generation standard calculated for category B?
4. How is the waste generation standard calculated for sediment in treatment facilities?
5. Provide examples of wastes classified as category B.
6. What is the waste localization coefficient?

Literature [1, 2]

Topic 3. Calculation of waste generation standards for categories G and D.

1. Which wastes are classified as category G?
2. Which wastes are classified as category D?
3. How is the waste generation standard calculated when the material or product is not fully utilized?
4. How is the waste generation standard calculated when the material or product is fully utilized?
5. Provide examples of wastes corresponding to each category.
6. What is the coefficient of waste localization?
7. What do the coefficients of pollution and deterioration indicate?

Literature [1, 2]

Topic 4. Calculation of damage caused to the environment by waste disposal on lands of different quality.

1. What is land pollution?
2. What is land littering?
3. How to calculate the size of damage caused by waste pollution to land?
4. How is the land pollution coefficient determined?
5. How to calculate the total size of damage caused by different pollutants to land?
6. How to calculate the size of damage caused by land littering?

Literature [1, 2]

4.3. Questions for semester control (examination) based on the results of studying the discipline

1. Any substances, materials, and objects that are formed during human activity and are not subsequently used in the place of formation or discovery, from which their owner intends or is obliged to dispose of them by means of their disposal or removal - is called… **[2, p. 22].**

2. Actions aimed at waste prevention, collection, transportation, storage, processing, utilization, removal, neutralization and deposition including monitoring and supervision of these operations and waste disposal sites - … **[2, p. 22].**

3. Waste whose physical, chemical and/or biological characteristics create (or may create) significant danger to the environment and human health and require special methods and ways of handling them… **[2, p. 22].**

4. The use of waste as secondary material or energy resources is considered to be... **[2, p. 23].**

5. Any technological operations related to the change in physical, chemical, or biological properties of waste, aimed at preparing them for environmentally safe storage, transportation, or disposal is considered to be... **[2, p. 23].**

6. Solid waste disposal sites belong to … - it is... **[2, p. 23].**

7. Operations on waste that do not lead to their disposal are considered to be... **[2, p. 23].**

8. Places or objects used for the collection, storage, processing, utilization, removal, neutralization, and deposition of waste are considered to be... **[2, p. 23].**

9. The process of organizing data on waste is called... **[2, p. 23].**

10. The central bodies of legislative and executive power are classified as **...** in the field of waste management **[2, pp. 36-40].**

11. The content of individual components of waste expressed as a percentage of the total waste mass is called... **[2, pp. 135-136].**

12. The method of heating organic substances to relatively high temperatures without access to air, which is accompanied by the decomposition of high molecular weight compounds into low molecular weight fractions (liquid and gaseous), coking, and tar formation is called... **[2, p. 187].**

13. The mixture of gases formed during anaerobic degradation of waste in the body of a landfill is called... **[2, p. 160].**

14. Waste generated in the course of human life and activities and accumulated in residential buildings, social and cultural institutions, public, educational, medical, commercial, and other facilities that have no further use at the place of their generation is called... **[2, p. 133].**

15. Places or objects used for the collection, transportation, storage, processing, utilization, removal, neutralization and deposition of waste are called... **[2, p. 23].**

16. According to the classification developed by the Ukrainian Scientific Research Institute of Environmental Problems (Kharkiv), residues of raw materials, materials, semi-finished products that cannot be used for their direct purpose due to changes in their physical state, geometric dimensions, or fractional-dispersed composition, as well

as chemical or substance composition resulting from the indiscriminate action of systematic or accidental factors, belong to the category of... **[2, p. 30].**

17. The methods for MSW disposal include: ... **[2, p. 157].**

18. The formation of biogas as a result of the biological decomposition of the organic component of MSW occurs during... **[2, p. 160].**

19. The most prioritized direction for handling production waste is called... **[2, p. 78].**

20. What is the duration for obtaining biogas in the MSW landfill? **[2, p. 162].**

21. The physical, chemical, and/or biological characteristics of waste create (or may create) significant danger to the natural environment and human health, requiring special methods and ways of handling, are called... **[2, p. 22].**

22. ... are actions aimed at waste prevention, collection, transportation, storage, processing, utilization, removal, neutralization and deposition including monitoring and supervision of these operations and waste disposal sites **[2, p. 22].**

23. Exhibitions, conferences, seminars, training and qualification improvement for specialists, information programs, educational plans are related to... **[2, p. 65].**

24. The physical properties of MSW include... **[2, p. 138-139].**

25. A type of hazardous waste that, when penetrating the body through the respiratory system, digestion, or skin, exerts a poisonous effect, may cause chronic or long-term diseases, is called... **[2, p. 22].**

26. Waste generated during human activity and accumulated in residential buildings without further use at the place of formation is called... **[2, p. 133].**

27. The thermochemical decomposition of the organic component of MSW into gaseous products by incomplete oxidation is called... **[2, p. 188].**

28. Waste management tools are instruments of direct state intervention in the field of waste management that are intended to ensure compliance with environmental legislation norms through planning, control and regulation functions are called... **[2, p. 46].**

29. Vermicomposting is the process of obtaining... **[2, p. 198].**

30. The main «vermiculture» is... **[2, p. 198].**

31. Activities related to the removal, accumulation, and placement of waste in specially designated locations or facilities, including waste sorting for further utilization or disposal, are called... **[2, p. 22].**

32. The use of waste as secondary material or energy resources is called... **[2, p. 23].**

33. Methods of processing the organic component of MSW include... **[2, p. 200].**

34. MSW accumulation norms are their quantity that... **[2, p. 142].**

35. The dimensions of large-size MSW components exceed... **[2, p. 147].**

5. LITERATURE FOR STUDYING THE COURSE

Module M-L1, M-P1

Basic literature

1. Shanyna T.P. Waste Management and Disposal: Lecture Notes. Dnipro: PBP Ekonomika, 2005. 144 p. [In Ukrainian]
2. Waste Management and Disposal: Textbook / Ed. by Prof. Safranov T.A., Prof. Klymenko M.O. Odesa: TES, 2012. 272 p. [In Ukrainian]
3. Management and Disposal of Municipal Waste: Practical Manual / T.A. Safranov, T.P. Shanyna, O.R. Hubanova, V.Yu. Prykhodko. Odesa: TES, 2014. 198 p. [In Ukrainian]
4. Collection of Methodical Guidelines for Practical Classes in the Discipline "Waste Management and Disposal." Odesa, 2008. 80 p. [In Ukrainian]
5. Methodical Guidelines for Self-Study, Examination, Course Projects, and Practical Work in the Discipline "Waste Management and Disposal" for Students of the Vth Year of Distance Learning in the Field of "Ecology, Environmental Protection, and Sustainable Natural Resource Management" / Ph.D. in Geography, Assoc. Prof. Prykhodko V.Yu., Ph.D. in Chemistry, Assoc. Prof. Shanyna T.P. Odesa: OSENU, 2017. 67 p. [In Ukrainian]

Additional literature

1. Hubanova O.R. Electronic Waste: Theory and Practice of Management. Odesa: TES, 2014. 120 p. [In Ukrainian]
2. Radovenchyk V. M., Homyela M. D. Solid Waste: Collection, Processing, Storage: Educational Manual. Kyiv: Kondor, 2010. 552 p. [In Ukrainian]
3. Organisation of awareness-raising events concerning the application and enforcement of community legislation on landfills. Final report / European Commission. - Brussels, 2008. -40 p.
4. Waste Management and Disposal. Part 2. Solid Household Waste: Educational Manual / Petruk V. H., Vasilykivsky I. V., Kvaternyuk S. M., et al. – Vinnytsia: VNTU, 2015. – 100 p. [In Ukrainian]
5. Safranov, T. A., Prykhodko, V. Y., & Mykhailenko, V. I. (2023). Plastic waste: assessment of the prosesses of its formation and management in the North-Western Black Sea Coast Regions. Ukrainian Hydrometeorological Journal, (31), 122-130. https://doi.org/10.31481/uhmj.31.2023.08
6. Prykhodko, V. Y., Mykhailenko, V. I., & Safranov, T. A. (2022). Evaluation of certain pollutants generation inside municipal solid waste landfills. Ukrainian Hydrometeorological Journal, (30), 73-80. https://doi.org/10.31481/uhmj.30.2022.06
7. Prykhodko, V. Y., Mykhailenko, V. I., & Safranov, T. A. (2022). Evaluation of certain pollutants generation inside municipal solid waste landfills. Ukrainian Hydrometeorological Journal, (30), 73-80. https://doi.org/10.31481/uhmj.30.2022.06
8. Mykhailenko V., Safranov T. Estimation of Input of Unintentionally Produced Persistent Organic Pollutants into the Air Basin of the Odessa Industrial-and-Urban Agglomeration. Journal of Ecological Engineering. 2021; 22(9): 21–31. DOI: https://doi.org/10.12911/22998993/141479

Module M-L2, M-P2

Basic literature

1. Shanyna T.P. Waste Management and Disposal: Lecture Notes. Dnipro: PBP Ekonomika, 2005. 144 p. [In Ukrainian]
2. Waste Management and Disposal: Textbook / Ed. by Prof. Safranov T.A., Prof. Klymenko M.O. Odesa: TES, 2012. 272 p. [In Ukrainian]
3. Management and Disposal of Municipal Waste: Practical Manual / T.A. Safranov, T.P. Shanyna, O.R. Hubanova, V.Yu. Prykhodko. Odesa: TES, 2014. 198 p. [In Ukrainian]
4. Collection of Methodical Guidelines for Practical Classes in the Discipline "Waste Management and Disposal." Odesa, 2008. 80 p. [In Ukrainian]
5. Methodical Guidelines for Self-Study, Examination, Course Projects, and Practical Work in the Discipline "Waste Management and Disposal" for Students of the Vth Year of Distance Learning in the Field of "Ecology, Environmental Protection, and Sustainable Natural Resource Management" / Ph.D. in Geography, Assoc. Prof. Prykhodko V.Yu., Ph.D. in Chemistry, Assoc. Prof. Shanyna T.P. Odesa: OSENU, 2017. 67 p. [In Ukrainian]

Additional literature

1. Hubanova O.R. Electronic Waste: Theory and Practice of Management. Odesa: TES, 2014. 120 p. [In Ukrainian]
2. Radovenchyk V. M., Homyela M. D. Solid Waste: Collection, Processing, Storage: Educational Manual. Kyiv: Kondor, 2010. 552 p. [In Ukrainian]
3. Organisation of awareness-raising events concerning the application and enforcement of community legislation on landfills. Final report / European Commission. -Brussels, 2008. -40 p.
4. Waste Management and Disposal. Part 2. Solid Household Waste: Educational Manual / Petruk V. H., Vasilykivsky I. V., Kvaternyuk S. M., et al. – Vinnytsia: VNTU, 2015. – 100 p. [In Ukrainian]
5. Safranov, T. A., Prykhodko, V. Y., & Mykhailenko, V. I. (2023). Plastic waste: assessment of the prosesses of its formation and management in the North-Western Black Sea Coast Regions. Ukrainian Hydrometeorological Journal, (31), 122-130. https://doi.org/10.31481/uhmj.31.2023.08
6. Prykhodko, V. Y., Mykhailenko, V. I., & Safranov, T. A. (2022). Evaluation of certain pollutants generation inside municipal solid waste landfills. Ukrainian Hydrometeorological Journal, (30), 73-80. https://doi.org/10.31481/uhmj.30.2022.06
7. Prykhodko, V. Y., Mykhailenko, V. I., & Safranov, T. A. (2022). Evaluation of certain pollutants generation inside municipal solid waste landfills. Ukrainian Hydrometeorological Journal, (30), 73-80. https://doi.org/10.31481/uhmj.30.2022.06
8. Mykhailenko, V. I., & Safranov, T. A. (2021). Estimation of Input of Unintentionally Produced Persistent Organic Pollutants into the Air Basin of the Odessa Industrial-and-Urban Agglomeration. Journal of Ecological Engineering, 22(9), 21-31.