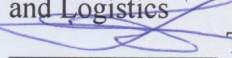


MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
 NATIONAL AVIATION UNIVERSITY
 Faculty of Environmental Safety, Engineering and Technologies
 Environmental Sciences Department



AGREED

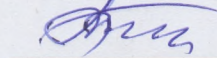
Dean of Faculty of Transport, Management
 and Logistics

 T. MOSTENSKA

«24» 01 2022

APPROVED

Vice-Rector for Academics

 A. POLUKHIN

«25» 01 2022



Quality Management System
COURSE TRAINING PROGRAM
 on
«Transport Ecology»

Educational and Professional Program: «Multimodal Transport and Logistics»

Field of study

27 «Transport»

Specialty:

275 «Air Transport Technologies»

Specialization:

275.04 «Air Transport Technologies»

Training Form	Semester	Total (hours/credits ECTS)	Lectures	Practicals	Lab classes	Self study	HW/CGP/TP	TP/CP	Semester Grade
Full-time	3	120/4.0	17	34	-	69	-	-	Graded test – 3s

Index: CB-7-275.04-3/21-3.3

ECB-7-275.04-3/21-3.3

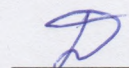
QMS NAU CTP 10.03.02-01-2022



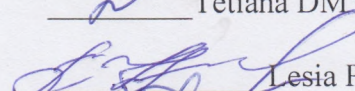
The Course Training Program on "Transport Ecology" is developed on the basis of the Educational and Professional Program: «Multimodal Transport and Logistics» Program, Bachelor Curriculum CB-7-275.04-3/21 and Bachelor Extended Curriculum ECB-7-275.04-3/21 for the Specialty 275 «Air Transport Technologies», Specialization 275.4 «Air Transport Technologies» and corresponding normative documents.

Developed by:

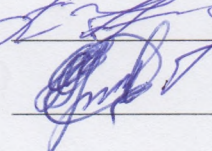
Associated Professor of Environmental Science Department

 Tetiana DMYTRUKHA

Associated Professor of Environmental Science Department

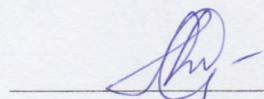
 Lesia PAVLIUKH

Associated Professor of Environmental Science Department

 Andrian YAVNIUK

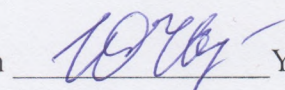
The course training program was discussed and approved by the Environmental Sciences Department, Minutes № 18 as of "21" 12 2021

Head of the Department

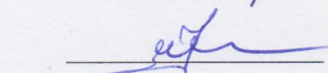
 Tamara DUDAR

The Course Training Program was discussed and approved by the Graduate Department of Organization of Aviation Works and Services, Educational Professional Program «Multimodal Transport and Logistics», specialty 275 «Air Transport Technologies», 275.04 specialization «Air Transport Technologies», Minutes № 1 as of «06» 01 2022

Guarantor of Educational and Professional Program

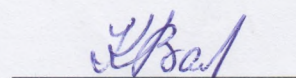
 Yurii CHOVIUK

Head of the Department

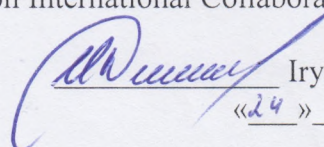
 Kateryna RAZUMOVA

The Course Training Program was discussed and approved by the Scientific-Methodical-Editorial Board of the Faculty of Environmental Safety, Engineering and Technologies, Minutes № 5 as of «21» 01 2022

Head of the SMEB

 Valentyna GROZA

Vice Rector on International Collaboration and Education

 Iryna ZARUBINSKA
«24» 01 2022

Document level – 3b

The Planned term between revisions – 1 year

Master copy



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INTRODUCTION

Course Training Program (CTP) of the subject «Radioecology» is developed on the basis of «Methodical instructions for the development and design of the Course Training Program for the subject», enacted by the order as of 29.04.2021 № 249/од and corresponding normative documents.

1. EXPLANATORY NOTES

1.1. Place, objectives, tasks of the subject.

The place of subject in the system of professional training. This subject is the theoretical basis of knowledge and skills that form the profile of a specialist in the field of natural sciences, in particular, in the field of environmental protection through transport services and aviation, improving the quality of transport processes and bringing passenger service closer to European standards.

The objectives of teaching the subject "Transport Ecology" is to provide future professionals with scientific and theoretical knowledge and practical skills on environmental quality, study of applied aspects of ecology, environmental safety in excessive stress on environmental components, legal aspects of environmental relations, the formation of higher education. modern ecological worldview and ecological culture.

The tasks of the subject are:

- study of the general state of the environment, conditions of formation and causes of its changes under the influence of natural and anthropogenic factors;
- study of the laws of interaction of aviation objects with the environment;
- mastering the principles of standardization of the impact of man-made objects on the components of the environment;
- mastering of normative and legal materials in the field of environmental protection, in particular in the organization of aviation works and services;
- determination of the main priorities of environmental protection, rational use of natural resources and ensuring environmental safety.

1.2. Learning outcomes that make it possible to achieve:

- analyze and justify the social significance of professional activities for sustainable development of the country;
- apply international and national standards and practices in professional activities;
- know and understand the impact of technical solutions in social, economic, social and environmental contexts;
- be able to evaluate the results obtained and defend the decisions made with arguments.

1.3. Competences that make it possible to acquire:

- the desire to preserve the environment;
- the ability to take into account natural factors in the organization of aviation works and services;
- the ability to solve tasks and make appropriate decisions;
- the ability to apply knowledge of legislation and state standards of Ukraine.



1.3. Interdisciplinary links.

The subject "Transport Ecology" belongs to the cycle of disciplines of free choice of students, occupies a relevant place in the structural and logical scheme of training of higher education students for the degree "Bachelor".

This discipline is based on knowledge of such disciplines as "Physics", "Chemistry", "Biology" and is the basis for the acquisition of soft skills.

2. COURSE PROGRAM

2.1. The subject content

The educational material of the discipline is structured on a modular basis and consists of one educational module №1 "Transport Ecology", which is logically complete, independent and integral part of the curriculum, the assimilation of which involves modular control work and analysis of its results.

2.2. Modular structuring and integrated module requirements

Module №1. "Transport Ecology"

Integrated requirements of module №1:

To know:

- the subject of study of transport ecology and the place of the discipline in the system of natural sciences;
- the impact of air transport on the environment;
- sources of environmental pollution in air transport processes;
- emission characteristics of aircraft engines and ground aircraft;
- principles of normalization of anthropogenic load on environmental components;
- normative-methodical and legal aspects of ensuring environmental safety in air transport processes;
- ecological and economic methods of environmental protection.

To be able:

- to determine the main sources of air pollution as a result of the organization of aviation works and services;
- determine the required degree of wastewater treatment, in particular by airlines;
- apply the principles and criteria for determining the level of soil contamination by air transport;
- apply the principles and criteria for the regulation of physical pollution, in particular in the area of influence of airports;
- have methods for estimating environmental and economic losses from environmental pollution.

Topic 1. The subject and objectives of transport ecology. Basic concepts and definitions. The unified transport system of Ukraine and its integration into the international system of transport corridors.

Introduction. Object, subject, purpose and tasks of modern transport ecology. Basic terms and definitions. The place of transport ecology in the system of natural, technical and economic sciences. The main stages of development of transport ecology.

Brief description of different modes of transport. The structure of the unified transport system of Ukraine. European transport axes.

Topic 2. Global environmental issues and air transport in the context of sustainable development.

Ecosystems, their structure and species. Causes of ecological crisis or imbalance in the Earth's biosphere. Causes of global environmental problems and their general characteristics. The contribution of aviation to global climate change. Impact of aviation on the ozone layer. Environmental problems of elimination of obsolete aircraft. The contribution of aviation to the formation of acid rain. Estimation of greenhouse gas and aerosol emissions and their contribution to the greenhouse effect. The impact of the environment on human health.



Topic 3. Characteristics of the impact on the natural environment of air transport. Comprehensive assessment of airports as a source of negative impact on the environment.

Characteristics of modern air transport of Ukraine. Technical and operational properties of air transport.

Control over the environmental performance of airports, reduce the level of negative environmental impact and compliance with environmental safety rules in the context of Ukraine's European integration and ratification by the country of international environmental safety rules for air carriers.

Topic 4. Assessment of the state of the atmosphere in the airport. Protection technologies.

Structure and main components of the atmosphere. Ecological functions of the atmosphere. Sources of air pollution and their classification. Impact of terrestrial sources of air transport on the environment. Emissions of harmful substances during the operation of aviation fuel supply companies. Analysis of air pollutants. Atmospheric air quality rationing. Environmental and scientific and technical standards. Determining the category of enterprise hazards. Emission standardization of aircraft engines. Methods and means of reducing emissions into the atmosphere.

Topic 5. Features of water pollution by air transport. Protection technologies.

General information about the hydrosphere. Ecological safety of the hydrosphere. Water use and water consumption. Types of pollution of natural reservoirs. The main sources of production of industrial wastewater by airlines. Pollution of surface and groundwater in the area of influence of airports. The impact of pollution on the vital functions of living organisms. Self-cleaning of natural reservoirs. Regulatory requirements for water quality. Water quality control and management. Ecological condition of reservoirs of Ukraine.

Topic 6. Features of soil pollution by air transport. Protection technologies.

General information about the lithosphere. Ecological safety of the lithosphere. Features of lithosphere pollution. The main factors of soil degradation. Influence of aviation and rocket and space technology on soils and on vegetation and soil cover. Chemical and physical contamination of soils. The principle of normalization of the content of harmful substances in the soil. Protection and rational use of soils. Regulatory support for the regulation of land relations in the field of land use of air transport. Landscape protection. Environmental, scientific, aesthetic, recreational value of nature reserves.

Topic 7. Electromagnetic pollution. Electromagnetic pollution in the airport area. Protection technologies.

The main sources of electromagnetic radiation. Electromagnetic pollution in the areas of operation of aviation and space technology. Influence of electromagnetic field strength on biological objects. Methods, means and measures to protect the environment from the dangerous effects of electromagnetic fields.


Topic 8. Acoustic pollution. Noise pollution in the airport area. New technologies for reducing the acoustic load from aircraft.

Sources of acoustic pollution. Noise effects of airports. Influence of noise on the person and vital activity of biocenoses. Standardization of industrial noise. Methods and means of environmental protection from acoustic pollution. Vibration. Vibration standardization and protection of the environment from vibration pollution.

Topic 9. Radioactive contamination and its impact on the environment.

Ionizing radiation of natural and artificial origin. Criteria for estimating and standardizing the effect of ionizing radiation. The peculiarity of their action on living organisms. Protecting the environment from ionizing radiation. Sources of radioactive contamination. The problem of processing and disposal of radioactive waste. Radiation safety standards of Ukraine (NRBU-97).


Topic 10. Ecological and economic methods of environmental protection. Promising areas of modern research in the field of greening of aviation.

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Economic management approaches in the field of environmental protection. Principles and ecological and economic assessment of restrictions on land use of air transport. Types of environmental payments. Limits on nature use. Fee for the use of natural resources. Payment for environmental pollution and deterioration of natural resources. Responsibility for violating environmental legislation.

2.3. Training schedule of the subject

№	TOPIC	Academic hours			
		Total	Lectures	Practicals	Self-study
1	2	3	4	5	6
3st semester					
Module 1 “Transport Ecology”					
1.1	The subject and objectives of transport ecology. Basic concepts and definitions. The unified transport system of Ukraine and its integration into the international system of transport corridors	10	2	2	6
1.2	Global environmental issues and air transport in the context of sustainable development.	10	2	2	6
1.3	Characteristics of the impact on the natural environment of air transport. Comprehensive assessment of airports as a source of negative impact on the environment	12	2 2	-	8
1.4	Assessment of the state of the atmosphere in the airport. Protection technologies	14	2 2	2	8
1.5	Features of water pollution by air transport. Protection technologies.	14	2 2	2	8
1.6	Features of soil pollution by air transport. Protection technologies	14	2 2	2	8
1.7	Electromagnetic pollution. Electromagnetic pollution in the airport area. Protection technologies	14	2 2	2	8
1.8	Acoustic pollution. Noise pollution in the airport area. New technologies for reducing the acoustic load from aircraft	11	2 2	2	5
1.9	Radioactive contamination and its impact on the environment	9	2	2	5
1.10	Ecological and economic methods of environmental protection. Promising areas of modern research in the field of greening of aviation	8	2	1	5
1.11	Module Test №1	4	2	-	2
1.12	Total for the module № 1	120	34	17	69
1.13	Total for the 3rd semester	120	34	17	69

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3.BASIC CONCEPTS OF QUADANCE ON THE SUBJECT

3.1. Teaching methods


When studying the subject, methods of organization and implementation of educational and cognitive activities of higher education, stimulation and motivation, control and self-control are used.

The implementation of these methods is carried out in lectures, laboratory works, test control, presentations, independent solution of practical problems in determining the properties and general patterns of environmental processes, rational and integrated use of natural resources, working with original, educational and scientific literature.

3.2. List of references (basic and additional)

Basic

- 3.2.1. Транспортна екологія: навчальний посібник / О. І. Запорожець, С. В. Бойченко, О. Л. Матвеева, С. Й. Шаманський, Т. І. Дмитруха, С. М. Маджд; за заг. редакцією С. В. Бойченка. – К.: НАУ, 2017. – 507 с.
- 3.2.2. Бойченко С.В. та ін. Авіаційна екологія: Навчальний посібник / С.В. Бойченко, М.М. Радомська, Л.М. Черняк, О.В. Рябчевський, Л.І. Павлюх. - К.: НАУ, 2014. – 150 с.
- 3.1.3. Бойченко С. В., Іванченко О. В., Казимір Лейда, Фролов В. Ф. Екологістика, рециклінг і утилізація транспорту: навчальний посібник/ МОН України, Національний авіаційний ун-т. – Київ: Центр учбової літ-ри, 2019. – 266 с.
- 3.2.4. Екологія, авіація та космос: навч. посіб. / Г.М. Франчук, В.М. Ісаєнко. – К.: НАУ-друк, 2010. – 456 с.
- 3.2.5. Білявський Г.О. та ін. Основи екології: Підручник / Г.О. Білявський, Р.С. Фурдуй, І.Ю. Костіков. – 2-ге вид. – К.: Либідь, 2005. – 408с.
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- 3.2.7. Cherniak L. Mikhyeyev O., Madzhd S., Lapan O., Dmytrukha T., Petrusenko V. Determination of the dependence of plants growth characteristics on the concentration of petrochemicals in the soil. *Journal of Ecological Engineering*. 2021. Vol. 22. Iss.2. P. 226–233.
- 3.2.8. Cherniak L. Mikhyeyev O., Madzhd S., Lapan O., Dmytrukha T., Korniienko I. Usage of plant test systems for determination of phytotoxicity of contaminated with petroleum products soil. *Journal of Ecological Engineering*. 2021. Vol. 22, Iss.6. P. 66–71.
- 3.2.9. Waste utilization and recuperation: Guide to Laboratory works for students of specialty 101 “Ecology” / Compilers: Pavlyukh L.I., Radomska M.M. – Kyiv: NAU, 2021. – 98 p.
- 3.2.10. Pavliukh, L. Perspectives of wastewater treatment by microalgae at an airport. *Science-based technologies*. Vol. 50. No 2. 2021. P.147-152.
- 3.2.11. L. Pavliukh, S. Shamanskyi, O. Zaiats. A flat-parallel photobioreactor design for sewage water treatment. *Science-based technologies*. 2021.Vol. 51. No 3. P. 237-244.
- 3.2.12. O. Lapan, O. Mikhyeyev, S. Madzhd, T. Dmytrukha, L. Cherniak, V. Petrusenko. Water Purification from Ions of Cadmium (II) Using a Bio-Plateau. *Journal of Ecological Engineering (JEE)*. 2020. – Volume 20, Issue 11. – P. 29–34.
- 3.2.13. Shamanskyi S., Boichenko S., Pavliukh L. Estimated Efficiency of Biogenic Elements Removal from Waste Water in the Ideal Displacement Photobioreactor. *Systems, Decision and Control in Energy II. Studies in Systems, Decision and Control*. 2021.-Vol.346.-p.347-361.

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Additional

- 3.2.14. Зеркалов Д.В. Екологічна безпека: управління, моніторинг, контроль. Посібник. – К: КНТ, Дакар, Основа, 2007. – 412 с.
- 3.2.15. Екологічний менеджмент: Навчальний посібник / За редакцією В. Ф. Семенова, О. Л. Михайлюк. – К: Знання, 2006. – 366 с.
- 3.2.16. Екологічне управління / В.Я. Шевчук, Ю.М. Саталкін, Г.О.Білявський та ін. – К.: Либідь, 2004. – 319 с.
- 3.2.17. Єремєєв І.С. Моніторинг довкілля (текст) навч.посіб. / І.С.Єремєєв, А.О.Дичко/ – Київ: Центр учбової літератури, 2016. – 500 с.
- 3.2.18. Інженерна екологія : підручник для студ. вищ. навч. закл. /В.А. Баженков, Ісаєнко В. М., Саталкін Ю. М., Трофімович В. В., Романова З. М., Навроцький В.М.- К. : Книжкове видво НАУ, 2006. 491 с.
- 3.2.19. Комитет по охране окружающей среды от воздействия авиации. Восьмое совещание. Доклад. – Монреаль, 1-12 февраля 2010 года: Монреаль, 2010. – 879 с.
- 3.2.20. Основи акустичної екології: Навчальний посібник / За редакцією В.С. Дідковського. – Кіровоград: Поліграфічно-видавничий центр ТОВ «Імекс ЛТД», 2002. – 520 с.
- 3.2.21. Буриченко Л.А., Ененков В.Г., Науменко И.М., Протоерейский А.С. Охрана окружающей среды в ГА. – М.: Машиностроение, 1992. – 320 с.
- 3.2.22. Загальна екологія: навч. посіб. / Г.М. Франчук, С.М. Маджд, М.М. Радомська, Є.О. Бовсуновський. – К.: НАУ, 2015. – 232 с.
- 3.2.23. Черняк Л.М., Міхєєв О.М., Маджд С.М., Лапань О.В., Дмитруха Т.І., Петрусенко В.П. наукові засади узагальнення якісної оцінки екологічного стану ґрунту, забрудненого нафтопродуктами // 6-й міжнародний конгрес “Сталий розвиток: захист навколишнього середовища. Енергоощадність. Збалансоване природокористування”: збірник матеріалів. – Львів : Західно-Український Консалтинг Центр (ЗУКЦ), ТЗоВ, 2020. – С. 46.
- 3.2.24. Anastasiia Turevych, Svitlana Madzhd, Larysa Cherniak, Anatoliy Pavlyuk and Vincent Ojeh. Modern means of assessing the impact of emergencies on the environmental condition of the ground layer of atmosphere. E3S Web Conf., 280 (2021) 09017. DOI: <https://doi.org/10.1051/e3sconf/202128009017>.

3.3. Internet resources

- 3.3.1. www.ecoleague.net/
- 3.3.2. <http://ecolog-ua.com/>
- 3.3.3. <http://epl.org.ua/>
- 3.3.4. <https://www.unian.ua/ecology>
- 3.3.5. <https://www.ukrinform.ua/tag-ekologia>



4. RATING SYSTEM OF KNOWLEDGE AND SKILLS ASSESSMENT

Assessment of certain types of educational work done by a student is carried out in balances according to the table. 4.1.

Grading of different kinds of academic activities performed by a student

Table 4.1

Kind of Academic Activity	Max Grade
3rd semester	
Module Test 1 «Transport Ecology»	
Carrying out and defending practical classes (№(1-2)×7=14 б.; №(3-9)×8=56 б.)	70
<i>For carrying out module test 1, a student must receive not less than</i>	42
Module Test 1	30
Totally for the subject	100

The credit rating is determined (in grades and by a national scale) based on the results of all types of academic activity during the semester.

4.2. Completed types of academic activity are credited to the student, if he received a positive grades for them (Annex 3).

4.3. The grades a student has been given for the different kinds of academic work are summed up and the result constituting a Current Module Grade is entered into the Module Grade Register.

4.4. The Total Semester Grade is translated into a national scale and an ECTS scale (Annex 5).

4.5. The Total Semester Grade is input into a student's record book, for example: **92/Ex/A, 87/Good/B, 79/Good/C, 68/Sat/D, 65/Sat./E**, etc.

4.6. The Total Semester Grade is equal to Total Semester Grade. Mentioned Total Semester Grade on subject is entered into Annex of Diploma Paper.



(Ф 03.02 – 01)

АРКУШ ПОШИРЕННЯ ДОКУМЕНТА

№ прим.	Куди передано (підрозділ)	Дата видачі	П.І.Б. отримувача	Підпис отримувача	Примітки
	19.02 (ОАДТ)	02.02.22	Гарубенко Н.М.		

(Ф 03.02 – 02)

АРКУШ ОЗНАЙОМЛЕННЯ З ДОКУМЕНТОМ

№ пор.	Прізвище ім'я по-батькові	Підпис ознайомленої особи	Дата ознайомлення	Примітки

(Ф 03.02 – 04)

АРКУШ РЕЄСТРАЦІЇ РЕВІЗІЇ

№ пор.	Прізвище ім'я по-батькові	Дата ревізії	Підпис	Висновок щодо адекватності



АРКУШ ОБЛІКУ ЗМІН

(Ф 03.02 – 03)

№ зміни	№ листа (сторінки)				Підпис особи, яка внесла зміну	Дата внесення зміни	Дата введення зміни
	Зміненого	Заміненого	Нового	Анульованого			

УЗГОДЖЕННЯ ЗМІН

(Ф 03.02 – 32)

	Підпис	Ініціали, прізвище	Посада	Дата
Розробник				
Узгоджено				
Узгоджено				
Узгоджено				