MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL AVIATION UNIVERSITY
Faculty of Transport, Management and Logistics
Air Transportation Management Department

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«06» 09 2023

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«06» 09 2023

Quality Management System

COURSE TRAINING PROGRAM
on
«Methodology of Applied Research in the Field of Transport Technologies (by modes) »

Educational Professional Program: «Air Transportation Management»

Field of study: 27 «Transport»
Speciality: 275 «Air Transport Technologies»
Specialization: 275.04 «Air Transport Technologies»

Training Form	Sem.	Total (hours/credits ECTS))	Lectures	Practicals	Lab. classes	Self-Study	HW/CGP	TP/CP	Semester Grade
Full-time:	1	105/3,5	17	17	–	71	–	–	Graded Test 1s

Index: CM-7-275-1/23-2.1.1

Course Training Program on «Methodology of Applied Research in the Field of Transport Technologies (by modes)» is developed on the basis of the Educational Professional Program "Air Transportation Management", Master Curriculum and Extended Master Curriculum № CM -7-275-1/23, № ECM -7-275-1/23 for Speciality 275 «Transport Technologies», Specialization 275.04 «Air Transport Technologies» and corresponding normative documents.

Developed by:
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Transportation Management Department _____ Anna ANTONOVA

Discussed and approved by the Graduate Department for Speciality 275 «Air Transport Technologies», Specialization 275.04 «Air Transport Technologies» and Educational Professional Program «Air Transportation Management» - Air Transportation Management Department, Minutes № _17___of «_05_»__09___2023.

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«___»_____2023

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INTRODUCTION

Course Training Program (CTP) of academic discipline " Methodology of Applied Research in the Field of Transport Technologies (by modes)" is developed on the basis of the Educational Professional Program " Methodical recommendations for development and design of the course training program for full-time and part-time forms of education", approved by the order № 249 dated 29.04.2021 and corresponding normative documents.

1. EXPLANATORY NOTES

1.1. Place, aim, objectives of the subject.

This subject is part of the theoretical basis of knowledge and skills for the study of technological subjects that train specialists in the field of of transportation management and transport technologies.

The aim of the subject is developing research skills and their further application during the preparation of the master's thesis and during the writing of scientific articles.

The tasks of the subject are:

- mastering the basic concepts of research;
- mastering the methodology and methods of scientific research, their practical use;
- mastering the basic principles and techniques of mathematical modeling of operations, the principles of selection of mathematical and software for the practical implementation of tasks;
- instill the skills of conducting research in professional activity.

1.2. Results of mastering the training course.

– PLO 01. Search for necessary information in scientific and technical literature, databases, other sources, analyze and objectively evaluate information in the field of transport systems and technologies and related interdisciplinary problems;

– PLO 07. Develop and analyze graphic, mathematical and computer models of transport systems and technologies;

– PLO 14. Use specialized software for the analysis, development and improvement of transport systems and technologies, in particular for air transport;

– PLO 17. Apply problem-oriented methods of analysis, synthesis and optimization of computer-integrated information systems for managing aviation transport complexes;

– PLO 18. Present the results of research activities, in particular, prepare publications, participate in discussions at conferences, symposia and other events;

1.3. Competencies of mastering the training course.

– IC. The ability of a person to solve complex tasks and problems of the transport industry in the field of professional activity according to a certain type of transport systems and technologies and in the learning process, which involves conducting research and implementing innovations and is characterized by the uncertainty of conditions and requirements.

– GC 03. Ability to search, process and analyze information from various sources;

– GC 07 Ability to conduct research at an appropriate level;

– PC 01. The ability to research and manage the functioning of transport systems and technology;

– PC 02. The ability to identify and apply promising directions for modeling transport processes, in particular on air transport;

– PC 11. The ability to use specialized software to solve complex problems in the field of transport systems and technologies, in particular in aviation transport;

– PC 14. The ability to apply modeling and optimization methods to research and increase the efficiency of the functioning of aviation transport systems and their management processes.

1.4. Interdisciplinary connections.

The subject is based on subject "Business Foreign Language" and is the basis for studying the subject "Project Management in the Field of Transport".

2. ACADEMIC CURRICULUM OF THE SUBJECT

2.1. Content of the subject.

Training material is structured according to module principle and consists of one educational module, namely:

– **Module №1 «Basic principles of scientific research and formatting of their results»,** which is logically complete, relatively independent, holistic part of the subject, learning of which provides module test and analysis of its performance.

2.2. Modular structuring and integrated requirements for module №1

Integrated requirements to module №1:

Know:

- basic concepts of scientific research;
- methodology and methods of scientific research, their practical use;
- basic principles and techniques of mathematical modeling of operations;
- principles of selection of mathematical and software for the practical implementation of tasks.

Be able:

- to form skills of carrying out scientific researches on professional activity.

Topic 1. Science as a sphere of human activity. Research methodology.

Concept of scientific research. Requirements for scientific research. Types of research. Concept of method and methodology of scientific research. Basic methodology of applied research. Empirical methods of scientific research (observation, experiment, comparison).

Topic 2. Theoretical methods of scientific research. Basic principles of review and analysis of scientific information.

Hypothesis, formalization, abstraction, idealization, generalization. Mathematical modeling and statistical processing of scientific data.

Analysis of previous theoretical and experimental data on the state of the problem. Drawing up a research plan and choosing the scientific apparatus of research. Experimental verification of model efficiency. Mathematical processing of research results.

Topic 3. Main sources of scientific information. Requirements for registration of research results.

Full-text, abstract, bibliographic, scientometric databases. Google Scholar search Web engine. Online educational resources.

Concept of academic literacy and academic writing. Goals and objectives of scientific communication. Features of preparation of the academic text. Structure of the study: justification of relevance and definition of the research topic. Registration of research results: report, abstracts of the report, article, thesis, dissertation. General rules for making references in scientific papers.

Topic 4. Fundamentals of academic integrity.

Values of academic integrity. Provision of academic integrity at the National Aviation University. Intellectual property and copyright in education and science. Plagiarism and its varieties. Prevention of plagiarism. Verification text systems.

Topic 5. Modeling generational technological change in aviation industry. Modeling the interaction between air carriers using the Lotka-Volterra equations.

Methods of transport processes modeling. Static and dynamic models. Mathematical models of the dynamics of generational technological change. Examples of competition and symbiosis models.

Topic 6. Application of analysis of variance to study of economic indicators of airline companies. The technique of conducting linear multiple regression when analyzing the impact of seasonality on air traffic volumes.

Estimation of the influence of random factors by statistical methods. Analysis of variance (ANOVA). Examples of applications ANOVA for the aviation industry using the MS Excel package.

Linear regression and correlation. Estimating the parameters of a paired linear regression using the least squares method. Estimating the statistical significance of regression and correlation coefficients. Nonlinear regression by parameters.

Methods of constructing multiple linear regression. Examples of applications the linear multiple regression to analysis of problems of the aviation industry based on the MS Excel package.

Topic 7. Analysis of annual air transportation trends and problems of its forecasting. Choosing an adequate forecasting model.

Components of the classical model of time series. Smoothing of the annual time series. Moving averages. Exponential smoothing. Calculation of trends by the least squares method: models of linear, quadratic and exponential trends.

Choosing an adequate forecasting model. Analysis of regression residuals. Examples of numerical analysis of annual passenger air transportation in EU countries.

Topic 8. Forecasting of monthly and quarterly air passengers transportation using the examples of airports and airlines.

Forecasting monthly and quarterly data using multiple linear regression with dummy variables. Examples of numerical analysis of quarterly passenger air transportation at Polish airports. Analysis of monthly air passengers transportation by low-cost companies

2.3. Structure of the subject.

№	Theme (thematic section)	Total, hours							
		Full-time education				Part-time education			
		Total	Lectures	Labs	Self-study	Total	Lectures	Labs	Self-study
1	2	3	4	5	6	7	8	9	10
Module №1 «Basic principles of scientific research and formatting of their results»									
1.1	Science as a sphere of human activity. Research methodology.	**1 semester**				**1 semester**			
		11	2	2	7	**11**	1	-	10
1.2	Theoretical methods of scientific research. Basic principles of review and analysis of scientific information.	**12**	2	2	8	**11**	1	1	9
1.3	Main sources of scientific information. Requirements for registration of research results.	**12**	2	2	8	**11**	1	1	9
1.4	Fundamentals of academic integrity.	**12**	2	2	8	**10**	-	1	9
1.5	Modeling generational technological change in aviation industry. Modeling the interaction between air carriers using the Lotka-Volterra equations.	**12**	2	2	8	**11**	1	1	9
1.6	Application of analysis of variance to study of economic indicators of airline companies. The technique of conducting linear multiple regression when analyzing the impact of seasonality on air traffic volumes.	**12**	2	2	8	**10**	1	-	9
1.7	Analysis of annual air transportation trends and problems of its forecasting. Choosing an adequate forecasting model.	**12**	2	2	8	**11**	1	-	10
1.8	Forecasting of monthly and quarterly air passengers transportation using the examples of airports and airlines.	**13**	2 1	2	8	**11**	-	1	10
1.9	Module test №1	**9**	-	1	8	-	-	-	-
1.10	Test (homework) (part-time education)	-	-	-	-	**8**	-	-	8
1.11	Final semester control work (part-time education)	-	-	-	-	**11**	-	1	10
Total by module №1		**105**	**17**	**17**	**71**	**105**	**6**	**6**	**93**
Total by subject		**105**	**17**	**17**	**71**	**105**	**6**	**6**	**93**

2.4. Tasks for test (homework) (part-time education).

Test (home work) on the subject is performed in order to consolidate and deepen the theoretical and practical knowledge and skills acquired in the process of mastering the educational material of the subject in the field of statistical analysis, which are used in the study of many subsequent subjects with basic and complete higher education .

This test is an important step in preparing a future specialist in the organization of transportation and transport management

Educational materials are approved by the minutes of the meeting of the graduating department, brought to the notice of the student individually and performed in accordance with the guidelines. The variant number of the theoretical part and the task is equal to the sum of the last two digits of the student's individual curriculum.

Time allotted for work - 8 hours of individual work.

2.5. List of questions to prepare for the final test.

The list of questions to prepare for the final test and its content are developed by the leading teachers and approved by the minutes of the department meeting and delivered to the students.

3. Basic concepts of guidance on the subject

3.1. Teaching methods

The following teaching methods of subject guidance are
- explanatory and illustrative method;
- method of problem presentation;
- reproductive method;
- research method.

The implementation of these methods are carried out during lectures, demonstrations, self-study, work with the educational material, analysis of transport technologies issues.

3.2. List of references (basic and additional)

Basic literature

3.2.1. Бхаттачерджи А., Ситник Н. Методологія та організація наукових досліджень: дослідження в соціально-економічних науках.– К.:НТУУ «КПІ ім. Ігоря Сікорського»,2022. –173 с.

3.2.2. Медвідь В. Ю., Данько Ю. І., Коблянська І. І. Методологія та організація наукових досліджень (у структурно логічних схемах і таблицях): навч. посіб. Суми: СНАУ, 2020. – 220 с.

3.2.3. Черноусенко О.Ю. Основи наукових досліджень та інженерної творчості: навч. посіб. / О.Ю. Черноусенко, О.О. Чепелюк, Д.В. Риндюк. – К.: КПІ ім. Ігоря Сікорського, 2016. – 270 с.

3.2.4. Berenson, M. L., Levine, D. M., Szabat, K. A., & Stephan, D. F. Basic business statistics: Concepts and applications (14th ed.). Harlow, UK: Pearson Education Ltd. 2020. – 911 p.

3.2.5. Washington, S., Karlaftis, M. G., Mannering, F., Anastasopoulos. P. Statistical and econometric methods for transportation data analysis. CRC Press. 2020. – 476 p.

Additional literature

3.2.6. Марінцева К. В. Наукові основи та методи забезпечення ефективного функціонування авіатранспортних систем: монографія / Марінцева К. В. ; Нац. авіац. ун-т. - Київ : НАУ, 2014. - 503 с.

3.2.7. Юринець В. Є. Методологія наукових досліджень : навч. посібник / МОН. – Львів : ЛНУ імені Івана Франка, 2014. – 178 с.

3.3. Internet information resources

3.3.1. Міністерство інфраструктури України. – [Електронний ресурс]. – Режим доступу: https://mtu.gov.ua/

3.3.2. Державна служба статистики України. – [Електронний ресурс]. – Режим доступу: https://ukrstat.gov.ua/

3.3.3. Державна авіаційна служба України. – [Електронний ресурс]. – Режим доступу: https://avia.gov.ua/pro-nas/statistika/periodychna-informatsiya/

3.3.4. Національна бібліотека ім. В.І. Вернадського. – [Електронний ресурс]. – Режим доступу: http://www.nbuv.gov.ua/

3.3.5. Наукова бібліотека НАУ. – [Електронний ресурс]. – Режим доступу: http://www.lib.nau.edu.ua/booksfornau.

3.3.6. Світовий банк. – [Електронний ресурс]. – Режим доступу: https://data.worldbank.org/indicator/IS.AIR.PSGR

3.3.7. ІКАО. – [Електронний ресурс]. – Режим доступу: https://www.icao.int/sustainability/pages/air-traffic-monitor.aspx

3.3.8. Євроконтроль (Європейська організація з безпеки аеронавігації). – [Електронний ресурс]. – Режим доступу: https://www.eurocontrol.int/publication/eurocontrol-forecast-update-2022-2028

4. RATING SYSTEM OF STUDENTS' KNOWLEDGE AND SKILLS ASSESSMENT

4.1. Assessment of certain kinds of student academic work is carried out in accordance with table 4.1.

Table 4.1

Kind of Academic Work	**Maximum Grade Values**	
	Full-time education	Part-time education
1 semester		
Module №1 «Basic principles of scientific research and formatting of their results»,		
Kind of academic work	Max Grade	Max Grade
Carrying out practicals (10p x 8)	80 (total)	30 (total)
Test (home work)	–	40
For admission to complete module test №1, a student must receive not less than	*48 points*	–
Final semester test	–	**30**
Module test №1	20	–
Total by module №1	**100**	**100**
Total by subject	**100**	

4.2. Completed types of educational work are credited to the student, if he received a positive rating for them.

4.3. The sum of rating assessments received by the student for certain types of completed academic work is the current modular rating assessment, which is recorded in the module control.

4.4. The final semester rating is converted into a grade on the national scale and the ECTS scale.

4.5. The final semester rating in points, on the national scale and the ECTS scale is entered in the test report, study card and individual curriculum of the student (record book), for example, as follows: ***92 / Excellent / A, 87 / Good / B, 79 / Good / C, 68 / Sat./D, 65 / Sat./E, etc.***

4.6. The Total Grade for the subject is equal to the average grade from Total Semester Grades with its further transformation into national scale and ECTS system.

The Total Grade is recorded to the Diploma Appendix.

(Ф 03.02 – 01)

АРКУШ ПОШИРЕННЯ ДОКУМЕНТА

№ прим.	Куди передано (підрозділ)	Дата видачі	П.І.Б. отримувача	Підпис отримувача	Примітки

(Ф 03.02 – 02)

АРКУШ ОЗНАЙОМЛЕННЯ З ДОКУМЕНТОМ

№ пор.	Прізвище, ім'я, по батькові	Підпис ознайомленої особи	Дата ознайом-лення	Примітки

(Ф 03.02 – 04)

АРКУШ РЕЄСТРАЦІЇ РЕВІЗІЇ

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

(Ф 03.02 – 03)

АРКУШ ОБЛІКУ ЗМІН

№ зміни	№ листа (сторінки)				Підпис особи, яка внесла зміну	Дата внесення зміни	Дата введен-ня зміни
	Зміненого	Заміненого	Нового	Анульо-ваного			

(Ф 03.02 – 32)

УЗГОДЖЕННЯ ЗМІН

	Підпис	Ініціали, прізвище	Посада	Дата
Розробник				
Узгоджено				
Узгоджено				
Узгоджено				