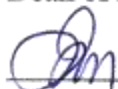


MINISTRY of EDUCATION and SCIENCE of UKRAINE
National Aviation University
 Aerospace Faculty
 Airport Technologies Department

AGREED

Dean of Aerospace Faculty

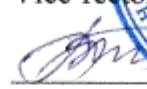


Mykola KULYK

« 10 » 05 2023

APPROVED

Vice-rector for Academics



*Anatoli POLUKHIN

« 10 » 05 2023



Quality Management System

COURSE TRAINING PROGRAM
 on
«Statistical Estimation and Problem Solving»

Educational Professional Program: Maintenance and Repair of Aircrafts and Engines

Educational Professional Program: Airport Technologies and Technical Equipment

Field of study: 27 Transport

Specialty: 272 Aviation Transport

Form of training	Semester	Total (hours / ECTS credits)	Lectures	Practicals	Laboratory classes	Self-study	HW/ CGW/ CW	TP/ CP	Form of semester control
Full-time	1	105/3,5	17	–	17	71	HW-1		Graded Test 1s

Index: ECM-1-272-1/22-2.1.3

Index: ECM-1-272-2/22-2.1.3

Index: ECM-1-272-2fs/22-2.1.3



The Course Training Program on «Statistical Estimation and Problem Solving» was developed on the basis of Educational Professional Programs «Maintenance and Repair of Aircrafts and Engines», «Airport Technologies and Technical Equipment», and Extended Curriculums ECM-1-272-1/22, ECM-1-272-2/22, ECM-1-272-2fs/22 for the «Master» educational degree seekers training for the Specialty 272 «Aviation Transport» and corresponding normative documents.

Developed by:
Professor of
Airport Technologies Department


Oleksandr TAMARGAZIN

Discussed and approved by the Graduate Department for the Educational Professional Program «Airport technologies and technical equipment», the Specialty 272 «Aviation Transport» – Department of Airport Technologies, Minutes № 3 of "22" 04 2023.

Guarantor of
Educational Professional Program


Oleksandr TAMARGAZIN

Head of the Department



Oleksandr TAMARGAZIN

Discussed and approved by the Graduate Department for the Educational Professional Program «Maintenance and repair of aircrafts and engines» - Department of Airport Technologies, Minutes № 3 of "24" 04 2023.


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Collaboration and Education


Iryna ZARUBINSKA
«10» 05 2023

Document level – 3b


The planned term between revisions – 1 year

Master copy

	Quality Management System Course Training Program on «Statistical Estimation and Problem Solving»	Document Code	QMS NAU CTP 07.02.06-02-2023
		Page. 3 of 11	

CONTENT

	page
INTRODUCTION	4
1. EXPLANATORY NOTES	4
1.1 Place, objectives, tasks of the subject	4
1.2. Learning outcomes the subject makes it possible to achieve.....	4
1.3. Competences the subject makes it possible to acquire	5
1.4. Interdisciplinary connections	6
2. COURSE TRAINING PROGRAM ON THE SUBJECT	7
2.1. The subject content	7
2.2. Modular structuring and integrated requirements for each module.....	7
2.3. Training schedule of the subject	8
2.4. Homework.....	9
2.5. List of questions for the exam.....	9
3. BASIC CONCEPTS OF GUIDANCE ON THE SUBJECT	9
3.1. Teaching methods	9
3.2. List of references.....	9
3.3. Information sources on the Internet	9
4. RATING SYSTEM OF KNOWLEDGE AND SKILLS ASSESSMENT	10

	Quality Management System Course Training Program on «Statistical Estimation and Problem Solving»	Document Code	QMS NAU CTP 07.02.06-02-2023
		Page. 4 of 11	

INTRODUCTION

Course Training Program (CTP) of discipline «Statistical Estimation and Problem Solving» is developed in accordance with the «Methodical recommendations for the development and design of the Course Training Program of the discipline of full-time of education», approved by the rector's order dated 29/04/2021 No. 249/od, and correspondent normative documents.

1. EXPLANATORY NOTE

1.1. Place, objectives, tasks of the subject

This educational discipline is the theoretical basis of totality of knowledge and outcomes, that forms the profile of specialist in the field of the airport technologies and technical equipment.

Purpose of teaching of the discipline is the systematization of knowledge and skills in statistical processing and analysis of operational information and information obtained in the process of conducting of experiments.

Tasks of learning of the discipline are:

- learning of knowledge of statistical information processing;
- learning of decision-making techniques for managing of technological processes at the airport based on the results of statistical information analysis.

1.2. Learning outcomes the subject makes it possible to achieve

At the end of the course, the student will be able to:

EPP «Airport technologies and technical equipment»

PTO02. To apply modern methods of scientific research, organisation and planning of the experiments, digital technologies, methods of data analysis to solve complex problems in the field of airport operation and operation of aviation ground equipment and airport equipment.

PTO09. To develop and to analyse physical, mathematical and computer models related to the creation, operation, maintenance and repair of aviation ground handling facilities and airport equipment.

PTO15. To search necessary data in scientific literature, databases and other sources, to analyze, to evaluate and to use these data.

EPP «Maintenance and repair of aircrafts and engines»

PTO01. Specialized conceptual knowledge includes modern scientific achievements in the field of aviation transport and is the basis for original thinking and conducting of research. To apply modern methods of scientific research, organization and planning of experiment, digital technologies, methods of data analysis to solve complex problems of aviation transport.

PTO02. To solve complex problems of creation, operation, maintenance, repair and utilization of aviation transport objects, including related fields, engineering sciences, physics, ecology and economy.


PTO05. To apply universal and specialized life cycle management (PLM), automated design (CAD), manufacturing (CAM) and engineering research (CAE) systems in professional activities.

PTO06. To develop and to implement energy-saving technologies of aviation transport.

PTO07. To organize and to manage the work of the primary production, design or research division in the field of aviation transport, to evaluate the effectiveness and efficiency of the activities of the staff and the division.

PTO08. To develop and to analyze physical, mathematical and computer models related to the creation, operation, maintenance and repair of aviation transport objects.

PTO10. To develop technical regulations, to take part in their development and to organize technological processes in the field of aviation transport, to provide production safety.

	Quality Management System Course Training Program on «Statistical Estimation and Problem Solving»	Document Code	QMS NAU CTP 07.02.06-02-2023
		Page. 5 of 11	

PTO11. To use the principles and methods of system analysis in scientific and technical activities, to analyze cause-and-effect links between significant factors and technical-economic characteristics.

PTO12. To ensure the operation of aircrafts, storage, refueling, maintenance and repair of aviation equipment.

PTO13. To develop production programs for technical maintenance, service, repair and other services in the operation of aviation equipment on the basis of deep fundamental and special knowledge.

PTO14. To carry out technological calculations of the enterprise in order to determine the needs for personnel, production and technical base, materials, spare parts.

PTO15. To control quality of maintenance and repair of aircrafts, to comply the state requirements of airworthiness and ensuring of flight safety during the operation of aviation equipment.

PTO16. To provide the safety of operation (including ecological), storage, maintenance of aviation equipment and technological equipment, safe working conditions of personnel.

PTO17. To analyze the technical and economic efficiency of the operation of aircrafts and technological processes, to participate in the development of recommendations for improving the operational and technical characteristics of the operation of aviation equipment.

PTO18. To develop models allow forecasting the change of the technical condition of aviation equipment objects, monitoring the parameters of the efficiency of its technical operation on the basis of modern analytical methods and complex models.

PTO19. To develop organizational and technical, regulatory and methodical documentation of the technical operation of aircrafts.

1.3. Competences the subject makes it possible to acquire

As a result of discipline studying, the student must acquire the following **competencies**:

EPP «Airport technologies and technical equipment»

GC01. Knowledge and understanding of the subject area and understanding of professional activities.

GC03. Skills of using of information and communication technologies.

GC04. Ability to conduct research at the appropriate level.

GC05. Ability to search, to process and to analyze information of various sources.

GC06. Ability to identify, to set and to solve problems.

GC07. Ability to make informed decisions.

GC09. Ability to evaluate and to ensure the quality of the performed works.


PC01. Ability to develop and to implement scientific and applied projects in the field of airport operation and operation of aviation equipment and airport equipment.

PC02. Ability to apply a systematic approach to solving engineering interdisciplinary problems in the field of airport operation and operation of aviation ground equipment and airport equipment.

PC04. Ability to integrate knowledge and to solve complex scientific and industrial problems in the field of airport operation and operation of aviation ground equipment and airport equipment, taking into account the wider interdisciplinary engineering context.

PC06. Ability to implement modern technologies, to research, to analyze and to improve technological processes in the field of airport operation and operation of aviation ground equipment and air-port equipment.

PC07. Ability to choose optimal materials, equipment and measures for the implementation of the latest technologies at the airport and during the operation of aviation ground equipment and air-port equipment.

	Quality Management System Course Training Program on «Statistical Estimation and Problem Solving»	Document Code	QMS NAU CTP 07.02.06-02-2023
		Page. 6 of 11	

EPP «Maintenance and repair of aircrafts and engines»

GC03. Skills of using of information and communication technologies.

GC05. Ability to search, to process and to analyze information of various sources.

GC06. Ability to identify, to set and to solve problems.

GC07. Ability to make informed decisions.

GC09. Ability to evaluate and to ensure the quality of the performed works.

PC01. Ability to develop and to implement scientific and applied projects in the field of aviation transport.

PC02. The ability to use the system approach to solving of engineering interdisciplinary problems in the field of aviation transport.

PC03. Ability to consider legal, social, environmental, ethical, economic and commercial aspects affecting decision-making and implementation in aviation transport.

PC04. Ability to integrate knowledge and to solve complex scientific and industrial problems in the field of airport operation and operation of aviation ground equipment and airport equipment, taking into account the wider interdisciplinary engineering context.

PC05. Ability to manage by technological processes in the field of aviation transport, which are complex, unpredictable and require new strategic approaches.

PC06. Ability to implement modern technologies, to research, to analyze and to improve technological processes in aviation transport.

PC07. Ability to choose optimal materials, equipment and measures for the implementation of new technologies in aviation transport.

PC08. Ability to plan, to organize and to carry out scientific research in the field of aviation transport.

PC09. The ability to apply modern methods of modeling and experimental research of objects and technological processes of aviation transport.

PC12. The ability to develop production programs for technical maintenance, service, repair and other services in the operation of aviation equipment based on fundamental and special knowledge.

PC13. The ability to carry out technological calculations of the enterprise in order to determine the needs of personnel, production and technical base, materials, spare parts.

PC16. Skills to evaluate the technical and economic efficiency of the operation of aircrafts and technological processes, readiness to participate in the development of recommendations for improving the operational and technical characteristics of the operation of aviation equipment.

PC17. The ability to develop models that allow predicting of changes in the technical state of objects of aviation equipment, to monitor the parameters of the efficiency of its technical operation on the basis of modern analytical methods and complex models.

PC18. The ability to develop plans, programs and methods of research, practical recommendations for the use of research results.

PC19. Ability to develop of organizational and technical, regulatory and methodological documentation for technical operation and repair of aircrafts and aircraft engines.

1.4. Interdisciplinary connections

This discipline is based on the obtained knowledge during the preparation for the educational degree «Bachelor» and is the basis for the study of further disciplines, namely:

EPP «Airport technologies and technical equipment»

«Business Foreign Language», «Information Technologies for Providing Maintenance Processes for Aviation Equipment», «Mathematical Modeling of Airport Technological Processes», «Operation of Aviation Ground Equipment and Airport Equipment», passing of Research Activities in the Field of Airport Technologies and Pre-diploma practice.



EPP «Maintenance and repair of aircrafts and engines»
«Maintaining the airworthiness of aircrafts (ICAO Doc. 9760)», passing of Research Activities in the Field of Maintenance and Repair of Aircrafts and Engines and Pre-diploma practice.

2. COURSE TRAINING PROGRAM ON THE SUBJECT

2.1. The subject content

The educational material of the discipline is structured according to the modular principle and consists of one educational **module №1, «Statistical Estimation and Problem Solving»**, which is a logically complete, independent, integral part of the educational discipline, the mastery of it provides a modular control work and analyzing the results of its implementation.

2.2. Modular structuring and integrated requirements for each module

Module №1 «Statistical Estimation and Problem Solving»

Module №1 integrated requirements:

To know:

- acquirement of knowledge of statistical information processing;
- acquirement of decision-making techniques for managing of technological processes at the airport based on the results of statistical information analysis.

To be able:

- to analyze the quality of received statistical information;
- to conduct research of statistical information using mathematical packages;
- to perform forecasting of changes of statistical functions over time;
- to find a connection between statistical information and factors that influence its implementation;
- to plan experiments with the purpose of minimizing of material and time resources.

Module 1. «Statistical Estimation and Problem Solving»

Topic 1.1. Statistical distributions of samples and their numerical characteristics.

General information. Discrete statistical distribution of the sample and its numerical characteristics. Interval statistical distribution of the sample and its numerical characteristics. Two-dimensional statistical distribution of the sample and its numerical characteristics. Even statistical distribution of the sample and its numerical characteristics. Empirical moments.

Topic 1.2. Statistical estimates of the parameters of the general totality.

General information. Point statistical estimates of the parameters of the general totality. Methods of determination of point statistical estimates. Probability distribution laws, \bar{x}_b , S^2 , S . Interval statistical estimates for general totality parameters. Construction of a confidence interval for \bar{X}_r at unknown value of σ_r with a given reliability γ .

Construction of confidence interval for \bar{X}_r at unknown value of σ_r with a given reliability γ . Construction of confidence interval with given reliability γ for D_r , σ_r . Construction of confidence interval for r_{xy} of the general totality with a given reliability γ . Construction of confidence interval for \bar{X}_r using Chebyshev's inequality with given reliability γ .

Topic 1.3. Statistical hypotheses.

General information. Parametric and non-parametric statistical hypotheses. Zero and alternative hypotheses. Simple and complex statistical hypotheses. Statistical criterion. Empirical value of the criterion. The area of acceptance of the hypothesis. Critical area. Critical point. A general algorithm for checking the correctness of the zero hypothesis. Errors of the first and second kind. Criterion power. Parametric statistical hypotheses. Checking of the correctness of non-parametric statistical hypotheses.

Topic 1.4. Elements of dispersion analysis.

General information. Univariate dispersive analysis. Two-factor dispersive analysis.

Topic 1.5. Elements of correlation and regression analysis.

General information. Linear even regression equation. Multiple linear regression. Non-linear regression. Nonlinear model by parameters.


2.3. Training schedule of the subject

№ ser.	Name of topic	Full-time education			
		Total	Lectures	Laboratory classes	Self-study
1	2	3	4	5	6
1.1	Discrete statistical distribution of the sample and its numerical characteristics	7	2	–	5
1.2.	Basic characteristics and experimental analysis of random variables	4	–	2	2
1.3	Two-dimensional statistical distribution of the sample and its numerical characteristics	7	2	–	5
1.4	Elementary statistical procedures	4	–	2	2
1.5	Methods of determining of point statistical estimates.	7	2	–	5
1.6	Full and fractional factorial experiments	4	–	2	2
1.7	Construction of confidence intervals with given reliability γ for D_r, σ_r	7	2	–	5
1.8	Random balance method	4	–	2	2
1.9	Statistical hypotheses	7	2	–	5
1.10	Planning of multivariate experiment in conditions of uncontrolled time drift	4	–	2	2
1.11	Univariate dispersive analysis	7	2	–	5
1.12	Planning of extreme search experiments	4	–	2	2
1.13	Two-factors dispersive analysis	7	2	–	5
1.14	Second-order planning	4	–	2	2
1.15	Elements of regression analysis	7	2	–	5
1.16	D-optimal experimental plans	4	–	2	2
1.17	Elements of correlation analysis	7	1	–	6
1.18	Execution of Calculation and Graphic Work	8	–	–	8
1.19	Module Test № 1	2	–	1	1
Total on the Module № 1		105	17	17	71
Total on the 1st semester		105	17	17	71
Total on the discipline		105	17	17	71

2.4. Homework

Homework (HW) of the discipline is carried out with the purpose of consolidating and improving of the theoretical knowledge and skills are acquired by the student in the process of mastering the educational material of the discipline in the field of mathematical modeling of technological and technical systems and processes related to aviation transport.

In the field of statistical processing of information obtained in operation or based on the results of special experiments for the purpose of making informed decisions on the management of

	Quality Management System Course Training Program on «Statistical Estimation and Problem Solving»	Document Code	QMS NAU CTP 07.02.06-02-2023
		Page. 9 of 11	

technological processes at the airport.

The task of HW is to investigate changes in the parameters of specific technological process in aviation using statistical methods.

Execution, registration and protection of the HW is carried out by the student individually in accordance with methodical recommendations.

Required time to complete the HW is up to 8 hours of self-study.

2.5. List of questions for the exam.

The list of questions and the content of tasks for the exam preparation are developed by the leading lecturer of the department in accordance with the Course Training Program, approved by the department and informed to the attention of the students.

3. BASIC CONCEPTS OF GUIDANCE ON THE SUBJECT

3.1. Teaching methods

The following educational methods are used during studying the discipline:

- explanatory-illustrative method;
- method of problem exposition;
- reproductive method;
- research method.

These methods realization is provided during lectures, demonstrations, individual tasks solution, reading of educational literature, analysis and resolution of conflict situations during the planning of technological processes at the airport.

3.2. List of references

Main references

3.2.1. Основи теорії ймовірностей і математичної статистики: навч. посібник. – Львів: ЛНУ імені Івана Франка, 2020. – 184 с.

3.2.2. Теорія ймовірностей та математична статистика: навчальний посібник / О. І. Огірко, Н. В. Галайко. – Львів: ЛьвДУВС, 2017 – 292 с.

3.2.3. Теорія ймовірностей та математична статистика: навч. посіб. / О. І. Кушлик-Дивульська, Н. В. Поліщук, Б. П. Орел, П. І. Штабальюк. – К: НТУУ «КПІ», 2014. – 212 с.

3.2.4. Douglas C. Montgomery, George C. Runger. Applied Statistics and Probability for Engineers, 2014, John Wiley & Sons, Inc. 836 p.

3.2.5. Anand M. Joglekar. Industrial statistics. Practical Methods and Guidance for Improved Performance, 2010 by John Wiley & Sons, Inc. 283 p.

Additional references

3.2.6. Теорія ймовірностей та математична статистика [Електронний ресурс]: підручник / Т. А. Ліхоузова. – Київ: КПІ ім. Ігоря Сікорського, 2018 – 341 с.

3.2.7. Thomas J. Quirk. Excel 2010 for Engineering Statistics Springer International Publishing Switzerland, 2014, 259 p.

3.2.8. Brian H. Hahn, Daniel T. Valentine. Essential MATLAB for Engineers and Scientists. 2013, Daniel T. Valentine. Published by Elsevier Ltd. 400 p.

3.3. Information sources on the Internet

3.3.1. <https://www.mathworks.com>

3.3.2. <https://www.statista.com>

4. RATING SYSTEM OF KNOWLEDGE AND SKILLS ASSESSMENT

4.1. The current grading of knowledge and skills acquired by the student is carried out according to 5-point system, *rating grade* is given: 1, 2, 3, 4, 5.

4.2. The *current module rating grade* is determined as the average value of the sum of the *rating grades* of all types of classes and control, provided by the educational work program (lectures, laboratory works and practical works, homeworks, TP, CP, testing, module test, graded test and exam, etc.).

4.3. The correspondence of the *current module rating grade* to the minimum value of the student's knowledge mark according to the 100-point scale of the European Credit Transfer System (ECTS) is established according to Table 1 (column 2).

Table 4.1

Current Module Grade	Minimal Grade Value of ECTS	Incentive Points	Total Grade of ECTS	Grade	Index
5	90	0-10	90 - 100	Excellent	A
4,5 - 4,9	82	0-10	82 - 89	Good	B
4,0 - 4,4	75	0-10	75 - 81	Good	C
3,5 - 3,9	67	0-10	67 - 74	Satisfactory	D
3,0 - 3,4	60	0-10	60 - 66	Satisfactory	E
2,5 - 2,9	35	0	35 - 59	Unsatisfactory	FX
1,0 - 2,4	1	0	1- 34	Unsatisfactory	F

4.4 The sum of incentive points according to table 2, which characterize the student's attitude to studying of the discipline (no more than 10 points), is added to the minimum value of the ECTS grade.

Table 4.2

№ ser.	Incentive Criterion	Points
1	Absence of missed classes	0 - 3
2	Activity during classes	0 - 3
3	Defending of works in time	0 - 2
4	Correct behavior	0 - 2

4.5. The sum of the minimal ECTS grade and incentive points are the *Total (Module, Semester) Grade*, which is entered in the module test report, study card, individual curriculum of the student, record book and diploma supplement, for example, as follows: **92 / Excellent / A, 87 / Good / B, 79 / Good / C, 68 / Sat./D, 65 / Sat./E**, etc.



(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 ознайомлення	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 введення зміни
	Зміненого	Заміненого	Нового	Анульованого			

(Ф 03.02 – 32)

УЗГОДЖЕННЯ ЗМІН

	Підпис	Ініціали, прізвище	Посада	Дата
Розробник				
Узгоджено				
Узгоджено				
Узгоджено				