Ministry of Education and Science of Ukraine
National Aviation University
Faculty of Transport, Management and Logistics
Air Transportation Management Department

APPROVED

Vice-Rector for Academics
_____ A. Gudmanian
«___»_____2020

Quality Management System

COURSE TRAINING PROGRAM
on
«Fundamentals of Ergonomics»

Field of Study: 27 «Transport»
Speciality: 275 «Air Transport Technologies»
Specialization: 275.04 «Air Transport Technologies»
Educational Professional Program: «Air Transportation Management»

Year of study – 2 Semester – 4

Lectures - 19 Examination – 4 Semester
Laboratory Classes - 38
Self-study - 63
Total (hours/ECTS credits) - 120/4,0

Calculatuion and Graphic Work (1) - 4 Semester

Index: ECB-7-275/17-2.2.6

The Course Training Program on «Fundamentals of Ergonomics» is based on the Educational Professional Program and Bachelor Extended Curriculum ECB-7-275/17 for Speciality 275 «Air Transport Technologies», Specialization 275.04 «Air Transport Technologies», Educational Professional Program «Air Transportation Management», Ukrainian version of this Course Training Program on "Fundamentals of Ergonomics", index РБ-7-275/17-2.2.5 approved by the Vice-Rector for Academics on ____ _____2019 and corresponding normative documents and order №207/од of 27.04.2018.

Developed by
Associate Lecturer of the Air Transportation
Management Department_____ T. Derevyanko

Associate Lecturer of the Air Transportation
Management Department_____ Y. Shevchenko

Assistant of the Air Transportation
Management Department _____D. Medinskiy

Discussed and approved by the Graduate Department for speciality 275 «Air Transport Technologies» Specialization 275.04 «Air Transport Technologies», Educational Professional Program «Air Transportation Management» – Air Transportation Management Department, Minutes № 3 of 10 February 2020.

Head of the Department_____ G. Yun

AGREED
Dean of the Faculty of
Transport, Management and
Logistics
_____ O.Ilienko
«___»_____2020

Director of the Institute
of Innovative Technologies and
Leadership

_____ K. Babikova
«___»_____2020

Level of document – 3b
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CONTENT

INTRODUCTION

The Course Training Program of the subject is developed based on the "Method guide to the development and execution of training programs and work training courses", entered into force by the decree of 13.07.17 №106/роз.

1. EXPLANATORY NOTE

1.1. The planned results.

The place of this subject in the system of professional training of a specialist.

This discipline "Fundamentals of ergonomics" is the theoretical and practical basis of the set of knowledge, skills and skills that form the outlook and profile of a specialist in the field of formation, evaluation of ergonomic systems "operator-machine-environment" (COME).

The purpose of teaching discipline is to provide students with up-to-date knowledge of ergonomic laws and scientific methods of studying the relationships and interactions between components of the ergonomic system, which contribute to improving the operational activities of the operator (person), as well as practical skills to use the knowledge acquired in the future practice.

The objectives of the subject are:

- ensuring the student's understanding of the systemic scientific and practical meaning of ergonomics science;
- ensuring the study of modern indicators to assess the state and determine the directions of development of the efficiency of the ergonomic system;
- providing knowledge about the existence of limited human capabilities, the relationship between biologically conditioned human limitations as a specialist and the ergonomic efficiency of his or her work in the operation of technical devices;
- providing future specialists and scientists with a tool to study the performance and optimization of COMS;
- - promoting the development of logical thinking and formation of a systematic approach for students in formulating and solving theoretical and practical issues in general and aviation ergonomics.

As a result of mastering the subject "Fundamentals of Ergonomics" students must be formed the following **competencies:**

- ability to evaluate and ensure the ergonomic efficiency of transport technologies;
- ability to evaluate the operational, technical, economic, technological, legal, social, and environmental components of transportation;
- ability to use professionally-profiled knowledge in the field of transport economics, organization, management, production planning, transportation technologies and regulatory support to develop all types of transportation resource.develop all types of transportation resource.

Interdisciplinary links of the subject

The course "Fundamentals of Ergonomics" is based on the knowledge of such disciplines as: "Computer Engineering and Programming", "Higher Mathematics" and is the basis for the study of such disciplines as: "Air Freight", "Air Passenger Transport".

1.2. Program of the subject.

Course of the subject is structured modularly and consists of two training module, namely: **Module 1. "Theoretical foundations of methodology of general ergonomics".**

Topic 1. Basic definitions of the discipline "Fundamentals of ergonomics" and its place in the system of sciences

General definition of the concept of "ergonomics", basic terms, definitions, statements and in the general ergonomics. Accident statistics. Tasks of ergonomics as a sphere of scientific and practical activity. Ergonomic requirements and features. Development of ergonomic thinking of humanity. Connection of ergonomics with other sciences. The main directions of development of ergonomics are physical, cognitive and organizational. Research Methods in Ergonomics.

Theme 2. Ergonomic standards. The man in the system "operator-machine"

Standardization of ergonomics. ISO / TC 159 Ergonomics standards. ISO / TC 159 / SC 1 General ergonomics principles, ISO / TC 159 / SC 3 Anthropometry and biomechanics, ISO / TC 159 / SC 4 Ergonomics of human-system interaction, ISO / TC 159 / SC 5 Ergonomics of the physical environment.

Human activity, its main types and trends of development. General patterns of regulation of labor activity. The difficulty of work. Anatomical, anthropometric, physiological and biomechanical characteristics and their impact on human physical activity. Working poses, loading and unloading work,

monotonous movements, work that threatens musculoskeletal disorders, workplace design, safety and health.

Theme 3. Individual psychological and physiological features of the operator (person)

Operator (human) characterization as a multicriteria object. The concept of competencies. Human thought processes. Perception, memory, reasoning, motor response and their role in human interaction with other elements of the ergonomic system. Optimization of mental and psychological load, decision-making processes. Mental processes of a person at work that requires high qualification, human-computer interaction, human reliability, occupational stress and professional burnout. Professional training in the field of air transportation.

Theme 4. The person in the system "operator-environment"

Environment as a Sociotechnical System. Influence of environment on human performance. Optimization of Sociotechnical Systems: Organizational Structure, Policy and Processes. The main areas of organizational ergonomics are communication, organizational culture, personnel management, activity design, working time design, teamwork, new paradigms of work organization, virtual organizations, remote work and quality management.

Topic 5. Operator interaction with the machine in normal and special conditions.

Characteristics of normal, emergency, special and stressful situations. Functioning of the system "operator (person) - machine-environment" in different situations. Prediction of the reaction of the system "operator (man)-machine-environment" in different situations.

Module 2. “Indicators and distribution of COMS functions”.

Topic 1. The main indicators of COMS and its components. Strategies for the development of COMS

A set of metrics related to the operator's (human) properties, which are manifested in production processes. A set of indicators related to the characteristics of the machine: functionality, the level of operational adaptability, trouble-free operation, the level of automation of the operator. Ergonomic parameters of the environment.

Summarizing the indicators of COMS. Advance and delay indicators of COMS. The concept of COMS effectiveness. The impact of COMS indicators on its effectiveness. The tasks of ergonomic design of COMS.

Topic 2. Entropy as an integrated indicator of the state of COMS

The concept of entropy as a measure of the uncertainty of the state or behavior of a system in these conditions. The laws of entropy. The Law of Necessary Diversity and Entropy of an Ergonomic System. Consequences of increased entropy of the ergonomic system. Entropy calculations and COMS entropy control methods.

Topic 3. Principles of Function Allocation in COMS

Features of the relationship between the specialist's limited human capabilities and the ergonomic efficiency of his work; features of the relationship between the aviation specialist's limited human capabilities and ergonomic aviation performance.

Principles of operator-oriented automation. Comparative characteristics of the operator and the machine. Principles of rational distribution of functions in COMS. Principles of full automation and robotization of works.

Theme 4. Generalization of theoretical and practical knowledge gained by students and prospects for the development of COMS

An overview of the theoretical issues studied and the main conclusions. An overview of the practical tasks accomplished and the RGR, the main conclusions from them. Possibilities of practical application of the acquired knowledge, skills and abilities in the future educational and professional activity of the students.

Directions for the development of COMS in the near term.

2. SUBJECT CONTENT

2.1. Plan of the subject

Table 2.1

№	Theme	Academic hours			
		Total	Lectures	Practicals	Self-study
1	2	3	4	5	6
4 Semestr					
Module №1 "Theoretical foundations of methodology of general ergonomics".					
1.1	Basic definitions of the discipline "Fundamentals of ergonomics" and its place in the system of sciences	11	2	4	5
1.2	Ergonomic standards. The man in the system "operator-machine"	11	2	4	5
1.3	Individual psychological and physiological features of the operator (person)	11	2	4	5
1.4	The person in the system "operator-environment"	10	2	4	4
1.5	Operator interaction with the machine in normal and special conditions	8	2	2	4
1.6	**Module test №1**	6	-	2	4
Total by the module №1		**57**	**10**	**20**	**27**
Module № 2 “Indicators and distribution of COMS functions”					
2.1	The main indicators of COMS and its components. Strategies for the development of COMS	14	4	4	6
2.2	Entropy as an integrated indicator of the COMS state	11	2	4	5
2.3	Principles of Function Allocation in COMS	11	2	4	5
2.4	Generalization of theoretical and practical knowledge gained by students and prospects for the development of COMS	10	1	4	5
2.5	Calculatuion and graphic work	10	-	-	10
2.5	**Module test №2**	7	-	2	5
Total by the module №2			**9**	**18**	**36**
Total by the 4 semester			**19**	**38**	**63**
Total by the subject			**19**	**38**	**63**

2.2. Lectures, their subject matter and scope

№	Theme	Academic hours	
		Lectures	Self-study
4 semester			
Module №1 "Theoretical foundations of methodology of general ergonomics".			
1.1	Basic definitions of the discipline "Fundamentals of ergonomics" and its place in the system of sciences	2	1
1.2	Ergonomic standards. The man in the system "operator-machine"	2	1
1.3	Individual psychological and physiological features of the operator (person)	2	1
1.4	The person in the system "operator-environment"	2	1
1.5	Operator interaction with the machine in normal and special conditions	2	1
Total by the module №1		**10**	**5**
Module № 2 "Indicators and distribution of COMS functions"			
2.1	The main indicators of COMS and its components. Strategies for the development of COMS	2	1
2.2	Entropy as an integrated indicator of the COMS state	2	1
2.3	Principles of Function Allocation in COMS	2	1
2.4	Generalization of theoretical and practical knowledge gained by students and prospects for the development of COMS	2	1
2.5	Settlement and graphic work	1	2
Total by the module №2		**9**	**6**
Total by the subject		**19**	**11**

2.3. Laboratory classes, their subjects and the scope

№	Theme	Academic hours	
		Practicals	Self-study
4 semester			
Module №1 "Theoretical foundations of methodology of general ergonomics".			
1.1	Basic concepts in occupational health, engineering psychology, psychology and physiology of work.	2	2
1.2	Natural cycles of operation of the operator (human)	2	2
1.3	Designing student workplace parameters and assessing his / her perfection	2	2
1.4	Formation of hierarchical structure of individually psychological and physiological features of the operator (person) and evaluation of their compliance with the characteristics of the machine	2	2
1.5	Human anthropological characteristics and evaluation of their compliance with the machine	2	2
1.6	Formation of environment characteristics as a component of the operator-environment system	2	2
1.7	Assessment of interaction and interaction of constituents of the operator-environment system	2	2
1.8	Determination of normal and special conditions from the point of view of the COMS operator	2	1
1.9	Formation of operator behavior in special conditions in accordance with the requirements of COMS and its psychophysiological characteristics on the example of the workplace of a specialist in the organization of air transportation	2	3
1.10	Module test №1	2	4
Total by the module №1			**22**

Module № 2 “Indicators and distribution of COMS functions”			
2.1	Formation of a balanced system of indicators of COMS	2	2
2.2	Formation of the COMS development strategy	2	2
2.3	Function distribution in COMS	2	2
2.4	Dynamics of Operator-Machine Functions	2	2
2.5	Calculation of maximum permissible norms of information loads of the operator	2	2
2.6	Calculation of maximum permissible norms of physical and psychological load of the operator	2	2
2.7	The entropy of COMS	2	2
2.8	The effectiveness of COMS	2	1
2.9	Module test №2	2	5
Total by the module №2			**20**
Total by the subject			**42**

2.4. Self-study student work, its content and scope

№	The content of the student's self-study	Self-study
4 semester		
1.	Working out the lecture material	11
2.	Preparation for practical classes	33
3.	Preparation for module tests №1, №2	9
4.	**Total by the subject**	10
Усього за навчальною дисципліною		Working out the lecture material

2.4.1. Calculation and graphic work

Calculation and Graphic Work (CGW) is carried out in the fourth semester, in accordance with approved methodological recommendations, with the aim of consolidating and deepening students' theoretical knowledge and skills and is an important stage in mastering the educational material taught in the seventh semester.

Calculation and graphic work "Determination of the parameters of the COMS workplace of the operator for the organization of air transportation" is performed on the basis of educational material, submitted for independent study by students, and is a component of module No. 2 "Indicators and distribution of functions of the COMS".

The purpose of the CGW task is to apply the theoretical knowledge and practical skills acquired by the student during the classroom and outside the classroom to form the indicators that characterize the GMS selected for the CGW.

The implementation, registration and protection of the RGR is carried out by the student individually in accordance with the methodological recommendations.

In order for the CGW to be successful, the student must know; higher mathematics and statistics; basics of information processing in Excel spreadsheets, components of COMS; characteristics of normal and special conditions of work of COMS; indicators characterizing COMS; be able to: determine the basic psychophysiological characteristics of the operator; determine compliance of the operator's characteristics with the machine's characteristics; to calculate the indicators characterizing the COMS and to shape the directions of its development.

The implementation, registration and protection of the CGW is carried out by the student individually in accordance with the methodological recommendations. It takes up to 10 hours to work independently.

3. EDUCATIONAL MATERIALS ON THE SUBJECT

3.1. Методи навчання

3.1. Methods of teaching.

In the teaching of the discipline "Operations research on transport ", it is proposed the use of such forms and methods of learning as lecture-visualization, elements of problem lecture, elements of dialogue with the audience (lectures - conversations), elements of "brain attack", workshops-discussions within the framework of practical occupations, business games, presentations.

3.2. Basic recommended sources

3.2.1. Скрипець А.В. Основи ергономіки / А.В. Скрипець. – К.: НАУ, 2001. – 400 с.

3.2.2. Гамаш Д. Л. Людський фактор та ергономіка (вступний курс) / Д. Л. Гамаш, П. І. Бідюк. - К. : Корнійчук, 2001. - 277 с.

3.2.3. Іваськевич І. О. Ергономіка : Навч. посіб. для студ. екон. і інж.-техн. спец. / І. О. Іваськевич; Терноп. акад. нар. госп-ва. - Т. : Екон. думка, 2002. - 164 с.

3.2.4. Поплавська О. М. Ергономіка : Навч. посіб. / О. М. Поплавська; Київ. нац. екон. ун-т ім. В.Гетьмана. - К., 2006. - 317 с.

3.2.5. Гаврилов Е. В. Системологія на транспорті : підручник: у 5 кн. Кн. 5. Ергономіка / Е. В. Гаврилов, М. Ф. Дмитриченко, В. К. Доля, О. Т. Лановий, І. Е. Линник, В. П. Поліщук. - К. : Знання України, 2008. - 256 с.

3.2.6. Поплавська О. М. Ергономіка : навч.-метод. посіб. / О. М. Поплавська, С. О. Цимбалюк; Держ. вищ. навч. закл. "Київ. нац. екон. ун-т ім. В.Гетьмана". - К., 2009. - 200 с. - укр.

3.2.7. Богачев С.К. Авиационная эргономика: вероятностные методы. – М: Машиностроение, 1978. -138 с.

3.2.8. Денисов В.Г., Козарук В.В. Эргономические вопросы эксплуатации оборудования воздушных судов: учебное пособие. –К.:МГА-КИИГА, 1975. -154 с.

3.2.9. Доброленский Ю.П., Завалова Н.Д., Пономаренко В.А., Туваев В.А. Методы инженерно-психологических исследований в авиации. -М.: Машиностроение, 1975.- 413 с.

3.2.10. Зинченко В.П., Мунипов В.М. Основы эргономики: учебное пособие для студентов университетов по специальности «Психология». -М.: МГУ, 1979.-344 с.

3.2.11. Шмид М. Эргономические параметры. -М.: Мир, 1980.- 240 с.

Additional recommended sources

3.2.12. Скрипець А.В. Основи ергономіки / А.В. Скрипець. – К.: Вид-во Нац. авіац.ун-ту «НАУ-друк», 2009. – 124 с.

3.2.13. Галаш Д.Л. Бідюк П.І. Людський фактор та ергономіка. Вступ. Курс. –К.: Корнійчук, 2001,- 379 с.

3.2.14. Іваськевич І.О. Ергономіка: навчальний посібник.- Тернопіль, Економічна думка. 2002,- 165 с.

4. **Internet Information resources**

4.2.2. The International Ergonomics Association (IEA). - https://www.iea.cc/

4.2.3. International Organization for Standardization. - https://www.iso.org/organization/9515.html

4.2.4. Каталог національних стандартів та кодексів усталеної практики. - http://uas.org.ua/ua/natsionalniy-fond-normativnih-dokumentiv/katalog-normativnih-dokumentiv-2/

4. The rating system of assessing students' knowledge and skills acquired

4.1 The evaluation of individual types of academic work done by a student is carried out in grades according to the table. 4.1.

Table 4.1

4 semester				
Module №1		**Module №2**		Max points
Type of academic work	Max points	Type of academic work	Max points	
Tasks during practical classes 1.1-1.9	27 (total)	Tasks during practical classes №2.1-2.8	24 (total)	
Tasks during testing theoretical knowledge	7 (total)	Tasks during testing theoretical knowledge	10 (total)	
For admission to perform module test № 1 student has to score ***at least 21 score.***		*For admission to perform module test № 2 student has to score* ***at least 21 score.***		
Module test №1	**10**	Module test №2	**10**	
Total by the module №1	**44**	**Total by the module №2**	**44**	
Semester Examination				**12**
Total by the 4 semester				**100**

Table 4.2

Correspondence of rating grades for certain types of classes in points is estimated on a national scale

Rating grades					Score in National scale
Tasks during practical classes		Tasks during testing theoretical knowledge		Module test	
№1.1-1.9	№2.1-2.8				
25-27	22-24	7	9-10	9-10	Excellent
20-24	18-21	6	8	8	Good
16-19	15-17	4-5	6-7	6-7	Satisfactory
Less than 16	Less than 15	Less than 4	Less than 6	Less than 6	Bad

4.3. The sum of rating grades received by the student for certain types of completed educational work is the current modular rating, which is entered into the details of the module control report.

4.4. The sum of the current and control modular rating grades is the final modular rating (tab.4.3), which, in points and national scale, is recorded in the module control report.

Table 4.3

Compliance summary modular rating
in points estimations by the national scale

Module №1	Module №2	Score in National scale
40-44	40-44	Excellent
33-39	33-39	Good
27-32	27-32	Satisfactory
Less than 27	Less than 27	Bad

4.5. The sum of the final modular rating marks in the marks is the final semester modular rating, which is converted into an assessment on a national scale (Table 4.4)

Table 4.4

Correspondence of the final semester modular rating estimation in scores on the national

Score in points	Score national scale
79-88	Excellent
66-78	Good
53-65	Satisfactory
Less than 53	Bad

Table 4.5

Correspondence of the graded /exam rating in the points of assessment on the national scale

Score in points	Score national scale
11-12	Excellent
9-10	Good
7-8	Satisfactory
Less than 7	Bad

4.6. The sum of the final semester modular and grading/examination rating in points is the final semester rating, which is converted into national scale and scale ECTS (Table 4.6).

Table 4.6

Correspondence of the final semester rating in scores on the national scale and scale ECTS

Score in points	Score national scale	Score scale ECTS	
		Score	Explanation
90-100	**Excellent**	**A**	**Excellent** (outstanding performance with only minor mistakes)
82-89	**Good**	**B**	**Very good** (above average with a few bugs)
75-81		**C**	**Good** (in general the right of execution of a certain number of significant errors)

67-74	**Satisfactory**	**D**	**Satisfactory** (not bad, but with a significant number of deficiencies)
60-66		**E**	**Enough** (performance meets the minimum criteria)
35-59	**Bad**	**FX**	**Bad** (with the possibility of re-Assembly)
1-34		**F**	**Bad** (with optional second rate)

4.7. The final semester rating in points, on the national scale and the ECTS scale is entered into the examination report, the curriculum and the student's record book.

4.8. The final semester rating score is entered into the student's record book and curriculum, for example: 92 / Excellent. / A, 87 / Good / B, 79 / Good / C, 68 / Satisfactory/ D, 65/ Enough/E, 40/ Bad/FX, etc.

4.9. The final rating score from the discipline is defined as the arithmetic mean score from the final semester rating scores in points (from this discipline - for the fourth and fifth semesters), followed by its translation into national scale and ECTS scales. The indicated summary rating from the discipline is entered in the Appendix to the diploma.

(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 зміни	Дата внесення зміни	Дата введення зміни
	Зміненого	Заміненого	Нового	Анульо-ваного			

(Ф 03.02 – 32)

УЗГОДЖЕННЯ ЗМІН

	Підпис	Ініціали, прізвище	Посада	Дата
Розробник				
Узгоджено				
Узгоджено				
Узгоджено				