

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
National Aviation University
Faculty of Transport, Management and Logistics
Aviation Transportations Management Department

APPROVED

Vice-Rector for Academics

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Quality Management System

Course Training Program
on
«Basics of Ergonomics»

Field of study: 27 «Transport»

Speciality: 275 «Transport technologies»

Specialization: 275.04 «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

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Calculation-graphic Paper (1) - 4 semester

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Introduction

The Course Training Program of the subject was developed based on "Methodological recommendations for the development and design of a work program of academic discipline", entered into force by the order 106 of 13.07.17 and correspondent normative documents.

1. Explanatory note

1.1. Planned results.

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

This academic subject "Fundamentals of Ergonomics" is a theoretical and practical basis of the totality of knowledge, skills and skills that form the worldview and profile of a specialist in the field of the formation, evaluation and evaluation of ergonomic systems "operator-machine-environment" (COMC).

The purpose of the subject is to provide students with modern scientific knowledge of ergonomic laws and scientific methods for studying interactions and interactions between components of the ergonomic system that contribute to improving the efficiency of the operator's work (human), as well as practical skills in using the knowledge gained in the future practice of organizing air travel .

The tasks of studying the discipline are:

- providing students with understanding of the systematic scientific and practical meaning of ergonomics science;
- ensuring the study of modern indicators that allow us to assess the state and determine the direction of the development of the efficiency of the ergonomic system;
- providing knowledge of the existence of limited human capabilities, the relationship between biologically determined human constraints as a specialist and the ergonomic efficiency of its work on the operation of technical devices;
- providing future specialists and researchers with tools for studying the effectiveness and optimization of COMC;
- promoting development in students of logical thinking and forming a systematic approach in formulating and solving theoretical and practical issues of general and aviation ergonomics.

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

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

Interdisciplinary connections

The subject "Fundamentals of Ergonomics" is based on the knowledge of such disciplines as "Computer Engineering and Programming", "Higher Mathematics" and is the basis for studying such disciplines as: "Air freight", "Air Passenger Transportation".

1.2. Program of the discipline.

The educational material of the discipline is structured modularly and consists of 2 educational modules, namely:

Module 1. «Theoretical foundations of the methodology of general ergonomics».

Theme 1. Basic definitions of the subject "Fundamentals of ergonomics" and its place in the system of sciences

The general definition of the term ergonomics, the basic terms, definitions, statements, and in general ergonomics. Accident statistics. The task of ergonomics as a sphere of scientific and practical activity. Ergonomic requirements and properties. Development of ergonomic thinking of humanity. The connection of ergonomics with other sciences. The main directions of ergonomics development are physical, cognitive and organizational. Methods of research in ergonomics.

Theme 2. Ergonomic standards. The person 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 regularities of the regulation of labor activity. The severity of labor. Anatomical, anthropometric, physiological and biomechanical characteristics and their influence on physical activity of a person. Work poses, loading and unloading



works, monotonous movements, work that threatens musculoskeletal disorders, designing a workplace, safety and health. Theme 3. Індивідуально-психологічні та фізіологічні особливості оператора (людини)

Characteristics of the operator (human) as a multi-criterion object. The concept of competencies. Human mental processes. Perception, memory, reasoning, motor reaction and their role in the interaction of man with other elements of the ergonomic system. Optimization of mental and psychological load, decision-making processes. The mental processes of a person at work, which requires high qualification, human interaction with a computer, human reliability, professional stress and professional burnout of a person. Professional training of specialists in the field of air transportation.

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

Environment as a socio-technical system. Influence of the environment on the ability of a person. Optimization of socio-technical systems: organizational structure, politics and processes. The main areas of organizational ergonomics are communication, organizational culture, personnel management, designing activities, designing working time, teamwork, new paradigms in the organization of work, virtual organizations, remote work and quality management.

Theme 5. Interaction of the operator with the car in normal and special conditions.

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

Module 2. «Indicators and distribution of functions of SOME».

Theme 1. Main indicators of SOME and its components. SOME development strategies

Complex of indicators related to the properties of the operator (person), manifested in the production processes. Complex of indicators related to the characteristics of the machine: functionality, level of operational technology, faultlessness in work, level of automation of the operator's work. Ergonomic environment settings.

Summarizing the indicators of SOME. SOME Preventive and Delayed Indicators. The concept of the effectiveness of SOME COMC. Mutual influence of COMC indicators on its effectiveness. The task of ergonomic design of COMC.

Theme 2. Entropy as an integrated indicator of the state of the SOME

The notion of entropy as a measure of uncertainty in the state or behavior of the system in these conditions. Laws of entropy. The law of the required variety and entropy of the ergonomic system. Consequences of increased entropy of ergonomic system. Estimation of entropy and methods of control of the entropy of SOME.

Theme 3. Principles of the distribution of functions in SOME

Features of the relationship between the limited human capabilities of a specialist and the ergonomic efficiency of his work; the features of the relationship between the limited human capabilities of aviation specialist and the ergonomic efficiency of aviation labor.

Principles focused on the operator of automation. Comparative characteristics of the operator and the machine. Principles of rational distribution of functions in. Principles of complete automation and work rotation.

Theme 4. Generalization of theoretical and practical knowledge received by students, and prospects for the development of SOME

An overview of the theoretical issues studied and the main conclusions. An overview of the accomplished practical tasks and the WGH, the main conclusions of them. Possibilities of practical application of the received knowledge, skills and abilities in the future training and professional activity of the students.

Areas of development of SOME in the nearest period of time.



2. Contents of the subject

2.1. Structure of the subject

Table 2.1

№	Topic	Academic Hours			
		All	Lectures	Laboratory	Self-study
1	2	3	4	5	6
4 semester					
Module №1 «Theoretical foundations of the 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 person 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	Interaction of the operator with the car in normal and special conditions	8	2	2	4
1.6	Module Test №1	6	-	2	4
Total for module №1		57	10	20	27
Module №2 «Indicators and distribution of functions of COMC»					
2.1	Main indicators of SOME and its components. SOME development strategies	14	4	4	6
2.2	Entropy as an integrated indicator of the state of the SOME	11	2	4	5
2.3	Principles of the distribution of functions in SOME	11	2	4	5
2.4	Generalization of theoretical and practical knowledge received by students, and prospects for the development of SOME	10	1	4	5
2.5	Settlement and graphic work	10	-	-	10
2.6	Module Test №2	7	-	2	5
Total for module №2		63	9	18	36
Total for the 4 semester		120	19	38	63
Total for academic subject		120	19	38	63



2.2. Lecture themes and hours

№	Topic	Academic Hours	
		Lectures	Self-study
4 semester			
Module №1 «Theoretical foundations of the 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 person 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	Interaction of the operator with the car in normal and special conditions	2	1
Total for module №1		10	5
Module №2 «Indicators and distribution of functions of SOME»			
2.1	Main indicators of SOME and its components. SOME development strategies	2	1
2.2	Principles of the distribution of functions in SOME	2	1
2.3	Entropy as an integrated indicator of the state of the SOME	2	1
2.4	The effectiveness of SOME	2	1
2.5	Generalization of theoretical and practical knowledge received by students, and prospects for the development of SOME	1	2
Total for module №2		9	6
Total for academic subject		19	11

2.3. Laboratory classes: themes and hours

№	Topic	Academic Hours	
		Lectures	Self-study
4 semester			
Module №1 «Theoretical foundations of the methodology of general ergonomics»			
1.1	Basic concepts on occupational hygiene, engineering psychology, psychology and physiology of labor.	2	2
1.2	Natural cycles of operator operation (human)	2	2
1.3	Designing the parameters of the student's workplace and evaluating his perfection	2	2
1.4	Formation of the hierarchical structure of the individual-psychological and physiological features of the operator (person) and their conformity to the characteristics of the machine	2	2
1.5	Anthropological characteristics of a person and their conformity to a car	2	2
1.6	Formation of the characteristics of the environment as a component of the "operator-environment" system	2	2
1.7	Evaluation of the interaction and mutual influence of the components of the operator-environment system	2	2
1.8	Determination of normal and special conditions in terms of the operator SOME	2	1
1.9	Formation of the operator's behavior in special conditions in accordance with the requirements of SOME and its psychophysiological characteristics on the example of a workplace specialist in the field of organization of air transportation	2	3
1.10	Module Test №1	2	4
Total for module №1		20	22

Module №2 «Indicators and distribution of functions of COMC»



2.1	Formation of a balanced system of indicators of SOME	2	2
2.2	Formation of SOME development strategy	2	2
2.3	Distribution of functions in SOME	2	2
2.4	Dynamics of functions in the system "operator-machine"	2	2
2.5	Calculation of the maximum allowable norms of information loads of the operator	2	2
2.6	Calculation of the maximum allowable norms of the physical and psychological loads of the operator	2	2
2.7	Entropy SOME	2	2
2.8	The effectiveness of SOME	2	1
2.9	Module Test №2	2	5
Total for module №2		18	20
Total for academic subject		38	42

2.4. Independent (individual) work of the student, its contents and volume

№	Contents of independent work of the student	Self-study (hours)
4 semester		
1.	Working out the lecture material	11
2.	Preparation for laboratory classes	33
3.	Preparation for modular control works №1, №2	9
4.	Settlement and graphic work	10
Total for academic subject		63

2.4.1. Settlement and graphic work

Settlement and graphic work is carried out in the fourth semester in accordance with approved methodological recommendations in order to consolidate and deepen the students' theoretical knowledge and skills and is an important stage in learning the teaching material that is taught in the seventh semester.

The settlement and graphic work "Definition of the parameters of the SOME of the workplace of the operator of the organization of air transportation" is carried out on the basis of the training material delivered to independent study by the students, and is an integral part of module №2 "Indicators and distribution of functions of SOME".

The purpose of the settlement and graphic work task is to apply theoretical knowledge and practical skills acquired by the student during the classroom and out-of-class sessions for the formation of indicators that characterize the choice for the settlement and graphic work SOME.

The execution, registration and protection of the settlement and graphic work is carried out by the student individually in accordance with the methodological recommendations.

Student must know for successful fulfillment of settlement and graphic work; higher mathematics and statistics; Basics of information processing in Excel spreadsheets, components of SOME; characteristics of normal and special conditions of work of SOME; indicators characterizing SOME; Be able to: define the basic psycho-physiological characteristics of the operator; to determine conformity of the characteristics of the operator to the characteristics of the machine; to calculate the indicators characterizing SOME and to form directions for its development.

The execution, registration and protection of the settlement and graphic work is carried out by the student individually in accordance with the methodological recommendations.

The time required to complete the settlement and graphic work is up to 10 hours of independent work.

3. Educational and methodological materials on subject

3.1. Methods of training

The teaching of the discipline "Fundamentals of ergonomics" provides for 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 classes, business games, presentations.



3.2. Recommended Literature (basic and additional)

Basic literature:

- 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 literature:

- 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.

Internet information resources:

- 3.2.15. The International Ergonomics Association (IEA). - <https://www.iea.cc/>
- 3.2.16. International Organization for Standardization. - <https://www.iso.org/organization/9515.html>
- 3.2.17. Каталог національних стандартів та кодексів усталеної практики. - <http://uas.org.ua/ua/natsionalniy-fond-normativnih-dokumentiv/katalog-normativnih-dokumentiv-2/>



4. Rating System of knowledge and skills assessment.

4.1. Methods of control and scoring of points.

Grading of different kinds of academic work performed by a student is done in accordance with Table. 4.1.

Table 4.1

4 semester				
Module №1		Module №2		Max Grade
Kind of academic work	Max Grade	Kind of academic work	Max Grade	
Performance of laboratory works 1.1-1.9	27 (total)	Performance of laboratory works №2.1-2.8	24 (total)	
Performance of tasks on knowledge of theoretical material	7 (total)	Performance of settlement and graphic work	10 (total)	
<i>For getting the admission for the module test №1 implementation student must have not less than 21 points</i>		<i>For getting the admission for the module test №2 implementation student must have not less than 21 points</i>		
Performance of module test №1	10	Performance of module test №2	10	
Total for module №1	44	Total for module №2	44	
Semester examination				12
Total for the 4 semester				100

4.2. The grades a student has been given for the different kinds of academic work are shown in Table 4.2.

Table 4.2

The grades for the different kinds of academic work

Rating score in points					National scale
Performance and defense of laboratory work		Performance of tasks on knowledge of theoretical material	Performance of settlement and graphic work	Performance 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 16	less 15	less 4	less 6	less 6	unsatisfactory

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 sum of the current and control modular rating ratings is the final modular rating (tab.4.3), which, in points and national scale, is recorded in the module control information

Table 4.3

Correspondence of the final semester rating grade
in points to the grade on the national scale and the scale of ECTS

Module №1	Module №2	National Scale
40-44	40-44	excellent
33-39	33-39	good
27-32	27-32	satisfactory
less 27	less 27	unsatisfactory

4.5. The Current Module Grade and the Module Test Grade together make up a

Total Module Grade whose correspondence to the National Scale is shown in Table 4.4..

Table 4.4

Table 4.5

Correspondence of the final semester modular rating grade in points on the national scale

Grade Values	National Scale
79-88	excellent
66-78	good
53-65	satisfactory
less 53	unsatisfactory

Correspondence of the examination rating grade in points on the national scale

Grade Values	National Scale
11-12	excellent
9-10	good
7-8	satisfactory
less 7	unsatisfactory

4.6. The Semester Module Grade and the Graded Test together make up a Total Semester Grade whose correspondence to the National Scale and the ECTS System is shown in (Table 4.6).

Table 4.6

Correspondence of the final semester rating grade in points to the grade on the national scale and the scale of ECTS

Grade in points	Grade on the national scale	Grade on the scale of ECTS	
		Grade	Explanation
90-100	Excellent	A	Excellent (excellent performance with few errors)
82-89	Good	B	Very good (higher average level with some errors)
75-81		C	Good (general the correct implementation with the certain number of significant errors)
67-74	Satisfactory	D	Satisfactory (not bad, but many drawbacks)
60-66		E	Sufficiently (performance meets the minimum criteria)
35-59	Bad	FX	Bad (with the possibility of the repass)
1-34		F	Bad (with the obligatory repeated course)

4.7. The Total Rating Module Grade on a subject is counted as a mean grade of total Semester Grade with it's following recount to the mark in ECTS. Considered Total Rating mark for the subject is put into Diploma Appendix.

4.8. The final semester rating score is entered into the student's student book and student card, for example: **92/Excellent./A, 87/Very good/B, 79/Good/C, 68/Satisfactory/D, 65/Sufficiently/E etc.**

4.9. The Total Rating Module Grade on a subject is counted as a mean grade of total Semester Grade with it's following recount to the mark in ECTS. Considered Total Rating mark for the subject is put into Diploma Appendix.

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 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 зміни	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				