Міністерство освіти і науки України
Національний аерокосмічний університет ім. М.Є. Жуковського
"Харківський авіаційний інститут"

кафедра "Проектування літаків і вертольотів" (№ 103)

ЗАТВЕРДЖУЮ

Керівник проектної групи

_____ М.М. Офлавський
(підпис) (ініціали та прізвище)

«30» квітня 2021 р.

РОБОЧА ПРОГРАМА ВИБІРКОВОЇ НАВЧАЛЬНОЇ ДИСЦИПЛІНИ

Технічна експлуатація повітряних суден

(шифр і назва навчальної дисципліни)

Галузь знань: 27 «Транспорт»
(шифр і найменування галузі знань)

Спеціальність: 272 «Авіаційний транспорт»
(код та назва спеціальності)

Освітня програма: «Технічне обслуговування та ремонт повітряних суден і авіаційних двигунів»
(назва освітньої програми)

Форма навчання: денна

Рівень вищої освіти: перший (бакалаврський)

Харків 2021

Робоча програма «Технічна експлуатація повітряних суден» для студентів
(назва навчальної дисципліни)
за спеціальністю :___ 272 «Авіаційний транспорт»
освітньої програми: «Технічне обслуговування та ремонт повітряних суден і авіаційних двигунів»

"30" серпня 2021 р, 14 с.

Розробник: к.т.н., доцент, доцент каф. 103 _____ Орловський М.М.

Робочу програму розглянуто на засіданні кафедри
Проектування літаків і вертольотів

Протокол № 2 від "30" серпня 2021 р.

Завідувач кафедри проектування літаків і вертольотів №103

к.т.н., доцент _____ (Гуменний А.М.)
(підпис) (прізвище та ініціали)

Ministry of Education and Science of Ukraine
N. Y. Zhukovsky National Aerospace University
«Kharkiv Aviation Institute»

Airplane and Helicopter Design Department (No. 103)

APPROVED
Guarantor of syllabus
_____ _____
(sign) (name)
«___» _____ 2021

SYLLABUS

For Optional Course

Aircraft Maintenance

(name of academic discipline)

Branch of knowledge: 27 Transport
(code and name of the field of knowledge)

Specialty: 272 Aviation Transport
(code and name of the specialty)

Educational program: Maintenance of Aircraft and Engines
(name of educational program)

Tuition form: full-time

Higher education level: First (baccalaureate)

Kharkiv 2021

The work program of "Aircraft Maintenance"
for students of specialty 272 Aviation Transport
educational program Maintenance of Aircraft and Engines

«30» 08 2021, - 15 p.

Developer: Sigaylo G.P., senior lecturer of 103 department,
(surname and initials, position, academic degree and academic title) (signature)

The syllabus was discussed on Airplane and Helicopter Design department meeting
(name of the department)

Protocol № 2 from «30» 08 2021

Head of the department Ph.D., Associate Professor A.M. Humennyi
(scientific degree and academic title) (signature) (initials and surname)

1. Description of the discipline.

<table>
<tr><td rowspan="2">Name of indicators</td><td rowspan="2">Field of knowledge, specialty, educational program, level of higher education</td><td>Characteristics of the discipline</td></tr>
<tr><td>Full-time education</td></tr>
<tr><td>Number of credits – 11</td><td rowspan="14">Branch of knowledge
27 Transport
(code and name)

Specialty 272 Aviation Transport
(code and name)

Educational program Maintenance of Aircraft and Engines
(name)

Level of higher education:

first (baccalaureate)</td><td>by choice</td></tr>
<tr><td>Number of modules – 2</td><td>Academic year</td></tr>
<tr><td rowspan="2">Number of content modules – 3</td><td>2021/2022</td></tr>
<tr><td>Semester</td></tr>
<tr><td rowspan="2">The total number of hours is 330
classroom – 136</td><td>7-and 8</td></tr>
<tr><td>Lectures</td></tr>
<tr><td rowspan="2">Number of weekly hours for full-time study:
Semester 7
classroom – 3,5
independent work of the student – 4
Semester 8
classroom – 6
independent work of the student – 8</td><td>62 hours</td></tr>
<tr><td>Practical, seminar</td></tr>
<tr><td>62 hours</td></tr>
<tr><td>Laboratory</td></tr>
<tr><td>12 hours</td></tr>
<tr><td>Individual work</td></tr>
<tr><td>0 hours</td></tr>
<tr><td>type of control</td></tr>
<tr><td>E</td></tr>
</table>

The ratio of the number of hours of classroom classes to independent individual work is:
for full-time education – 136/194

2. The purpose and objectives of the discipline.

The purpose of the study – mastering the basic provisions for the organization of technical operation, maintenance of A/C, maintaining a given level of reliability and flight safety.

Objective: mastering the scientific base in the field of organization and implementation of processes of technical operation of air transport; consolidation of previously acquired knowledge in the following disciplines: basics of aviation and astronautics; computer science and basics of programming; aerodynamics and flight dynamics; theory, design of aircraft and aircraft engines, etc., mastering the practical skills of maintenance and safe performance of standard maintenance works; intensification of education and preparation of students for the choice of field and specialty of practical activity.

Acquired competencies:

General competencies: (GC):

GC2 – Ability to apply knowledge in practical situations.

GC3 – Knowledge and understanding of the subject area and understanding of professional activity.

GC7 – Ability to make informed decisions.

GC8 – Ability to evaluate and ensure the quality of work performed.

GC9 – Safe skills.

GC10 – Ability to evaluate and ensure the quality of work performed.

Professional competences of the specialty (PC):

PC1 – Ability to ensure the safety and cost-effectiveness of aircraft flights.

PC3 – Ability to choose optimal solutions when planning actions in the event of special situations.

PC4 – Ability to provide safety and labor protection at the work site.

PC7 − Skills to work with regulations, reference books and other sources of information governing the activities of air transport.

PC8 − Ability to participate in a set of planned and preventive works to ensure the serviceability, efficiency and readiness of aircraft to effectively use them for their intended purpose.

PC9 − Ability to perform professional primary skills, including metalwork, manufacture and repair of simple parts, assembly of components to ensure the serviceability, efficiency and readiness of aircraft to use them for their intended purpose and with the lowest operating costs.

PC10 − Ability to maintain technical documentation and compile established reports according to approved forms.

PC11 − Ability to solve tasks on planning the technical operation of aircraft, operational reliability, regularity of flights.

PC12 − Skills to analyze the reliability of aircraft, experience in its technical operation, planning measures to prevent aviation accidents and incidents, failures and damage to aircraft in order to maintain the airworthiness of aircraft and ensure flight safety.

Estimated results of studying (RS):

RS 1 – Ensure the safety and cost-effectiveness of aircraft flights.

RS 3 – Choose the best solutions when planning actions in conditions of special situations.

RS 4 – Provide safety and labor protection at the work site.

RS 7 – Summarize information on regulatory documentation, reference books and other sources of information governing the activities of air transport.

RS 8 – Ensure a set of planned and preventive work on A/C in order to keep it ready for effective use as intended.

RS 9 – Ensure the implementation of professional primary skills, including metalwork, manufacture and repair of simple parts, assembly of components to ensure the serviceability, efficiency and readiness of aircraft for their intended use and with the lowest operating costs.

RS10 – Analyze technical documentation and established reporting according to the approved forms, including the accounting of resource and technical condition of A/C.

RS11 – To plan the solution of tasks on technical operation of A/C, operational reliability, regularity of flights, organization, information and hardware support of production processes for maintenance and repair of A/C.

RS12 – Analyze the reliability of aircraft, the experience of its technical operation and plan measures to prevent aviation events and incidents, failures and damage to A/C in order to maintain the airworthiness of A/C.

Student should **know**:

- design and operational properties of A/C;
- processes of determining the technical condition of A/C;
- methods and strategies of maintenance;
- comprehensive maintenance quality management system;
- methods of assessment and ways to increase the efficiency of the processes of A/C and aircraft engines maintenance;

- operating conditions, rules and standard work on aircraft maintenance and labor protection;
- fuels and lubricants and ground equipment used in aircraft maintenance;
- organization of flights in civil aviation;
- engineering bases of aircraft flight operation.

Student should **be able**:

- organize compliance with the rules of operation of aircraft on the ground;
- perform certain maintenance work on the aircraft, control, diagnose and forecast the technical condition of A/C and aircraft engines;
- ensure the maintenance process safety precautions level required.
- to assess quality of fuels and lubricants, special liquids and gases;
- to analyze the causes of malfunctions, violations of the rules of technical operation of aircraft, to develop measures to prevent and eliminate them.

Student should **have an idea**:

- on trends in changes in the principles of operation of aircraft of next generations.

Prerequisites – Aircraft Ground Maintenance Technologies, Airport Operation and Airport Technologies, Aviation Legislation, Aircraft Interface Systems, Basics of Flight Safety, Structure and Strength of Aircraft, Aircraft Operating Life and Durability, Aviation Fuel and Lubrication Systems

Corequisites – Aerodrome practice, Bachelor Final Work.

3. The program of the discipline.

Module 1.

<u>Content module 1.</u> Aircraft as an object of technical operation.

THEME 1. Introduction to the course. Aircraft maintenance and operation. General.

Subject of the discipline. Scientific and methodological grounds. Interrelation with other disciplines. Order of learning and reporting. Recommendations with reference to knowledge acquisition and enhancement. Main requirements to maintenance and operation of aircraft and engines. Safety precautions during operation of aircraft.

THEME 2. Maintenance regulations.

Directives on operation and maintenance of the A/C and engines. Air law. Registration documents. Operational and technical documents.

THEME 3. Basics of reliability.

Reliability components. Faillessness. Failure rates. Methods of on-reality analysis. Ensuring reliability requirements at the stages of aircraft design and testing. Durability, basic concepts and definitions. Indicators of durability. Methods for determining the

resource. Operational manufacturability, basic concepts and definitions. Indicators of operational manufacturability. Generalized indicators of operational manufacturability. Unit indicators of operational technology. Assessment of the level of operational manufacturability.

Content module 2. System, strategies and programs of aircraft maintenance.

THEME 4. System of technical operation of A/C.

Structure of aircraft maintenance systems. Characteristics of individual states of the maintenance process. Interrelation of aircraft states and changes in technical condition of aircraft parts.

THEME 5. Maintenance strategies.

Maintenance organizational forms. Characteristics of maintenance strategies.

THEME 6. Types of maintenance.

Classification of types of maintenance. Characteristics of forms of operational maintenance. Characteristics of forms of periodic maintenance. The structure of the maintenance program. Formation of a comprehensive program of maintenance of A/C.

Module 2.

Content module 3. Maintenance of airframe and functional systems of A/C and aircraft engines.

THEME 7. Aircraft airframe maintenance.

Visual inspection of aircraft structural members. Skin damages identification. Structure protection and awareness. Fasteners and torque moment. Fasteners installation and removal. Lock wiring and sealing. Safety precautions.

THEME 8. Aircraft control systems maintenance.

Aircraft control systems intended purpose. Visual inspection of aircraft control systems. Basic rules of maintenance of control systems. Typical operational malfunctions of control systems. Safety precautions.

THEME 9. Aircraft landing gear maintenance.

Aircraft landing gear intended purpose. Visual inspection of aircraft landing gear. Basic rules of maintenance of landing gear. Typical operational malfunctions of landing gear. Safety precautions.

THEME 10. Aircraft fuel systems maintenance.

Aircraft fuel systems intended purpose. Visual inspection of aircraft fuel systems. Basic rules of maintenance of fuel systems. Aircraft fuelling procedure. Typical operational malfunctions of fuel systems. Safety precautions.

THEME 11. Aircraft hydraulic systems maintenance.

Aircraft hydraulic systems intended purpose. Visual inspection of aircraft hydraulic systems. Basic rules of maintenance of hydraulic systems. Typical operational malfunctions of hydraulic systems. Safety precautions.

THEME 12. Aircraft pneumatic systems maintenance.

Aircraft pneumatic systems intended purpose. Visual inspection of aircraft pneumatic systems. Basic rules of maintenance of pneumatic systems. Typical operational malfunctions of pneumatic systems. Safety precautions.

THEME 13. Aircraft environment control systems maintenance.

Aircraft environment control systems intended purpose. Visual inspection of aircraft environment control systems. Basic rules of maintenance of environment control systems. Typical operational malfunctions of environment control systems. Safety precautions.

THEME 14. Aircraft anti-icing system maintenance.

Aircraft anti-icing system intended purpose. Visual inspection of aircraft anti-icing system. Basic rules of maintenance of anti-icing system. Typical operational malfunctions of anti-icing system. Safety precautions.

THEME 15. Aircraft fire protection system maintenance.

Aircraft fire protection system intended purpose. Visual inspection of aircraft fire protection system. Basic rules of maintenance of fire protection system. Typical operational malfunctions of fire protection system. Safety precautions.

THEME 16. Aircraft engine lubricant system maintenance.

Aircraft engine lubricant system intended purpose. Visual inspection of aircraft engine lubricant system. Basic rules of maintenance of engine lubricant system. Typical operational malfunctions of engine lubricant system. Safety precautions.

THEME 17. Visual inspection of A/C.

Aircraft exterior walk-around check which is made by technicians, a route and basic rules.

Aircraft Maintenance Task Work.

4. The structure of the discipline.

Themes	total, hrs.	lectures, hrs.	practical classes, hrs.	laboratory classes, hrs.	Independent work, hrs.
1	2	3	4	5	6
Semester 7.					
Module 1.					
Content module 1.					
1. Introduction to the course. Aircraft maintenance and operation. General.	17	4	4		9
2. Maintenance regulations.	24	6	6		12
3. Basics of reliability.	27	6	6		15
Total	68	16	16		36
Content module 2.					
4. System of technical operation of A/C.	25	6	6		13
5. Maintenance strategies.	17	4	4		9
6. Types of maintenance.	25	6	6		13
Total	67	16	16		35
Semester 8.					
Content module 3.					
7. Aircraft airframe maintenance.	39	8	10		23
8. Aircraft control systems maintenance.	8	2	2		4
9. Aircraft landing gear maintenance.	8	2	2		4
10. Aircraft fuel systems maintenance.	20	4	4		12
11. Aircraft hydraulic systems maintenance.	8	2	2		4
12. Aircraft pneumatic systems maintenance.	8	2	2		4
13. Aircraft environment control systems maintenance.	8	2	2		4
14. Aircraft anti-icing system maintenance.	8	2	1		4
15. Aircraft fire protection system maintenance.	8	2	1		4
16. Aircraft engine lubricant system maintenance.	12	2	2		8
17. Visual inspection of A/C.	8	2	2		4
Total	135	30	30		75
Aircraft maintenance TW	60			12	48
TOTAL FOR DISCIPLINE	330	62	62	12	194

5. Topics of seminars.

Nos	Theme	Hours
1		
	Total	

6. Topics of practical classes.

Nos	Theme	Hours
1	Main requirements to maintenance and operation of aircraft and engines.	4
2	EASA registration documents.	6
3	Reliability components.	6
4	Structure of aircraft maintenance systems.	6
5	Maintenance strategies.	4
6	operational and periodic maintenance. The structure of the maintenance program.	6
7	Skin damage identification.	2
8	Structure damage identification.	2
9	Wheel well doors backlash checking.	2
10	Fasteners and torque moment.	2
11	Lock wire securing.	2
12	Aircraft control systems maintenance.	2
13	Aircraft landing gear maintenance.	2
14	Aircraft fuel systems maintenance.	4
15	Aircraft hydraulic systems maintenance.	2
16	Aircraft pneumatic systems maintenance.	2
17	Aircraft environment control systems maintenance.	2
18	Aircraft anti-icing and fire protection systems maintenance.	2
19	Aircraft engine lubricant system maintenance.	2
20	Aircraft exterior walk-around check.	2
	Total	**62**

7. Topics of laboratory classes.

Nos	Theme	Hours
1	Formulation of the problem. Task description.	2
2	Overview of current issues.	10
	Total	**12**

8. Independent work.

№	Name topics	Number of hours
		Full-time education
1	Aircraft maintenance and operation. General.	4

2	Main requirements to maintenance and operation of aircraft and engines.	5
3	EASA registration documents.	6
4	Operational and technical documents.	6
5	Reliability components. Faillessness.	2
6	Reliability components. Durability. Indicators of durability.	3
7	Reliability components. Operational manufacturability. Assessment of the level of operational manufacturability.	4
8	Ensuring reliability requirements at the stages of aircraft design and testing, basic concepts and definitions.	2
9	Methods for determining the resource.	4
10	Structure of aircraft maintenance systems.	3
11	Characteristics of individual states of the maintenance process.	4
12	Interrelation of aircraft states and changes in technical condition of aircraft parts.	6
13	Maintenance organizational forms.	4
14	Characteristics of maintenance strategies.	5
15	Classification of types of maintenance.	3
16	Characteristics of forms of operational maintenance.	3
17	Characteristics of forms of periodic maintenance.	3
18	The structure of the maintenance program. Formation of a comprehensive program of maintenance of A/C.	4
19	Safety precautions while working on airframe	2
20	Visual inspection of aircraft structural members.	3
21	Skin damages identification.	4
22	Structure protection and awareness.	5
23	Fasteners and torque moment.	3
24	Fasteners installation and removal.	3
25	Lock wiring and sealing.	3
26	Safety precautions while working on control systems.	2
27	Typical operational malfunctions of control systems.	2
28	Safety precautions while working on landing gear.	2
29	Typical operational malfunctions of landing gear.	2
30	Safety precautions while working on fuel systems.	2
31	Aircraft fuelling procedure.	6
32	Typical operational malfunctions of fuel systems.	4
33	Safety precautions while working on hydraulic systems.	2
34	Typical operational malfunctions of hydraulic systems.	2
35	Safety precautions while working on pneumatic systems.	2
36	Typical operational malfunctions of pneumatic systems.	2
37	Safety precautions while working on environment control systems.	2

38	Typical operational malfunctions of environment control systems.	2
39	Safety precautions while working on anti-icing systems.	2
40	Typical operational malfunctions of anti-icing system.	2
41	Safety precautions while working on fire protection systems.	2
42	Typical operational malfunctions of fire protection system.	2
43	Safety precautions while working on engine lubricant systems.	2
44	Visual inspection of aircraft engine lubricant system. Typical operational malfunctions of engine lubricant system.	6
45	Aircraft exterior walk-around check which is made by technicians, a route and basic rules.	4
46	Aircraft maintenance TW	48
	Total	**194**

9. Individual tasks.

During the study of the discipline, it is recommended to draw up an individual summary on each topic for presenting it (if necessary) to the teacher in order to control the independent work.

10. Teaching methods.

Conducting classroom lectures, laboratory classes, practices, individual consultations (if necessary), independent work of students on materials published by the department (methodical manuals) and leading aviation organizations, the use of Internet materials and electronic materials posted on the website of the department.

11. Methods of control.

1. Evaluation of practical work.
2. Assessment of written assignments.
3. Interviews with students on independent work on topics of meaningful modules.

12. Evaluation criteria and distribution of points received by students.

12.1. Distribution of points received by students (quantitative evaluation criteria)

Components of educational work	Points for one lesson (task)	Number of classes (tasks)	Total number of points
Content module 1			
Work on lectures	0… 1	8	0… 8
Execution and protection of laboratory (practical) works	1 ... 2	3	3...6
Modular test	5… 9	1	5… 9
Content module 2			

Work on lectures	0… 1	8	0… 8
Execution and protection of laboratory (practical) works	1 ... 2	3	3...6
Modular test	5… 10	1	5… 10
Content module 3			
Work on lectures	0… 1	15	0… 15
Execution and protection of laboratory (practical) works	1 ... 2	14	14... 28
Modular test	5… 10	1	5… 10
Total for the semester			**60… 100**

Semester test (credit), which is carried out in case of refusal of the student from points of current testing and in the presence of the admission to credit. During the semester test the student has the opportunity to receive a maximum of 100 points.

The test card consists of 2 questions. The maximum number of points for each question is 50.

12.2. Qualitative evaluation criteria

The required amount of knowledge to obtain a positive assessment:

- modern concepts, concepts and methods in the field of organization of the regulatory framework and procedures for regulating airworthiness;
- existing sources of air law;
- regulatory framework in the field of civil aviation security;
- structure and legal framework of the International Civil Aviation Organization (ICAO) and the European Organization EASA.
- on international conventions and international treaties that regulate and ensure the safety of civil aviation, the legal regime of airspace, air commercial transport, the legal basis for the lease, chartering and exchange of aircraft, the regulatory framework;
- Civil Aviation Service: legal bases, functions and powers, legal provisions laid down in the Air Code of Ukraine;
- requirements laid down in Part 66, Part 145, Part 21, Part 147, for personnel certifying the certification of the developer, manufacturer, operator of aircraft, aircraft maintenance and repair enterprises.

The required amount of skills to obtain a satisfactory assessment:

- apply basic concepts in practice;
- apply procedures and methods that allow to perform safe flights under the established operating conditions;
- use procedures and methods for aircraft certification;

– draw up legal requirements for personnel certifying aircraft maintenance;
– determine the basic procedures and requirements for air safety.

12.3 Criteria for evaluating student work during the semester

Unsatisfactory (0 - 59), if the student has fragmentary knowledge of the question.

Satisfactory (60 - 74), if the student is familiar with the basic concepts of the study material, but there is no justification for the material presented, there are some errors. All practical works have been worked out and defended, the answers contain incorrect interpretation of certain questions and inaccuracies in the formation of procedures and methods.

Good (75 - 89), if the answers to all questions are of a reproductive nature, not taking into account all the features of the provisions and procedures, the answers may contain certain errors of a non-fundamental nature that do not affect the essence of the question.

Excellent (90 - 100) -the student must know the basic and additional material, give clear and logical answers to the questions, be able to analyze the requirements for flight safety, know the legal basis of international and state regulation of airworthiness of aircraft

Grading scale: point and traditional

The sum of points	Score on a traditional scale	
	Exam, grading test	Test
90 - 100	Perfectly	Credited
75 - 89	Fine	
60 - 74	Satisfactorily	
0 - 59	Unsatisfactorily	Not credited

13. Methodical support

Abstracts of lectures and literature in the library, methodical office and in electronic form on the server of the Department of Aircraft and Helicopter Design (listed below in section 14 of this program).

14. Recommended reading

Basic

1. Смирнов Н.Н., Ицкович А.А. Обслуживание и ремонт авиационной техники по состоянию. М.: Транспорт,1980.-232 с.
2. Пугачов А.І.. Техническая эксплуатация летательных аппаратов. М. Транспорт, 1974, 439с.
3. Орлов К.Я., Пархимович В.А. «Ремонт самолетов та вертолетов». М. Транспорт, 1986, 295с.
4. Альбом конструкций агрегатов и систем самолета Ан-74Т-200А /

С.В.Воронов, А.Г. Гребеников и др. – Учебное пособие. – Харьков: НАКУ “ХАИ”, 2006.-180с.
5. Самолет Ан-74ТК-300. Стандартная спецификация / Гребенников А.Г. , П.А. Клюев и др. – Учебник. - Харьков: НАКУ “ХАИ”, 2004.- 277с.
6. An-74T-200A Fircraft. Standard Specification / A.G. Grebenikov, P.A. Kluyev etc. Textbook. – Kharkov: National Aerospace University “Kharkov Aviation Institute”, 2004. – 320p.
7. Technical operation of aircraft. Orlovsky MN, Yakovlev Yu. A. Kharkov; NACU "HAI", 2011 - 180p.
8. Orlovsky MN, Shaabdiev SS Maintenance of airworthiness of aircraft. Kharkiv, NAKU named after NE Zhukovsky "KHAI", 2015. - 104p.

Auxiliary

1. Orlovsky MN Maintenance of aircraft and aircraft engines. Textbook. Kharkiv, NAKU named after NE Zhukovsky "KHAI", 2014. - 190p.
2. Гончаренко О.Д. «Основные положения требований по организации технической эксплуатации и ремонту авиационной техники гражданской авиации». Харків Національний Аерокосмічний університет «ХАІ» 2001, 212с.
3. Орловський М.М., Літвін В.Л. Контроль гідравлічних систем літальних апаратів у процесі експлуатації.- Харків: ХІ ВПС. 2004, 69 с.
4. Вертолет Ми-24. Инструкция по технической эксплуатации. Планер и силовая установка. Книга 1. М.: Машиностроение, 1983.
5. Инструкция экипажу вертолета Ми-8Т.(В двух книгах). Изд.4. Кн.1.- М.: Воениздат, 1980.

15. Information resources

Department website 103 http://k103.khai.edu/ru/site/page/view