Ministry of Education and Science of Ukraine
National Aerospace University
“Kharkiv Aviation Institute”

Department of Aircraft Manufacturing Technology (#104)

APPROVED

Guarantor of the
Educational Program
_____ V. T. Sikulsky
(Signature) (Name and Surname)

«____» _____ 2021

WORK PROGRAM
OF COMPULSORY EDUCATIONAL DISCIPLINE

"Introduction to Aerospace Engineering"
(name of academic discipline)

Field of Knowledge: 13 "Mechanical Engineering"
(code and name of the field of knowledge)

Program Subject Area: 134 "Aerospace Engineering"
(code and name of the specialty)

Educational Program: "Aircraft Design, Manufacturing and Certification"
(name of educational program)

Training Mode: Full-Time

Level of Higher Education: First (Bachelor)

Kharkiv 2021

Developed by: Myronova S.Yu., Senior Lecturer of Department 104 _____
(surname and initials, position, academic degree, and academic title) (signature)

_____ _____
(surname and initials, position, academic degree, and academic title) (signature)

The work program was considered at the meeting of the Department of Aircraft Manufacturing Technology (#104)
(The Department Name)

Protocol № _1_ from "_26_" _August_ 2021

Head of the Department: Dr. of Eng. Sciences, Senior Researcher — I. V. Bychkov
(Sci. Degree And Acad. Title) (Signature) (name and surname)

1. Description of The Discipline

<table>
<tr><td>Characteristic</td><td>Field of knowledge, specialty, educational program, level of higher education</td><td>Characteristics of the discipline
(full-time education)</td></tr>
<tr><td>ECTS - 1.0</td><td rowspan="14">Branch of knowledge
13 "Mechanical Engineering"
(Code And Name)

Program Subject Area
134 "Aerospace Engineering"
(Code And Name)

Educational Program
"Aircraft Design, Manufacturing and Certification"
(Name)

Level of Higher Education:
first (bachelor)</td><td>Compulsory</td></tr>
<tr><td>Number of modules - 1</td><td>Academic year</td></tr>
<tr><td>Number of content modules - 1</td><td>2021/2022</td></tr>
<tr><td>Individual task
_____
(Name)</td><td>Semester</td></tr>
<tr><td rowspan="2">The total hours is 16*/30</td><td>1st</td></tr>
<tr><td>Lectures*</td></tr>
<tr><td rowspan="6">Weekly hours
for full-time study:
classroom - 2
independent work of the student – 1.75</td><td>_8_ hours</td></tr>
<tr><td>Practical, Seminar *</td></tr>
<tr><td>_8_ hours</td></tr>
<tr><td>Laboratory *</td></tr>
<tr><td>_0_ hours</td></tr>
<tr><td>Independent Work</td></tr>
<tr><td>_14_ hours</td></tr>
<tr><td>Type Of Control</td></tr>
<tr><td>Modular Control,
Test</td></tr>
</table>

The ratio of the number of hours of classroom classes to independent work is: 48/72

*Classroom load can be reduced or increased by one hour depending on the class schedule.

2. The Purpose and Objectives Of The Discipline

Goal: To give students a coherent system of knowledge about the engineering foundations of Aerospace Technology and the system of technologies of their manufacturing, operation and repair, to prepare students for the study of general engineering and special disciplines.

Task: general acquaintance of students with the history of Aerospace Technology development, the current state and prospects of aviation science and the process of creation and production of Aerospace Technology; with the terminology of general concepts of manufacturing and preproduction, the system of technological transformations during the production of aircraft and its life cycle; providing brief information about the composition and essence of technological processes of manufacturing aircraft parts and processes of assembly and testing of aircraft

Acquired Competencies:

GC 1. Knowledge and understanding of the subject area and understanding of the professional activity.

GC 2. Ability to abstract thinking, analysis, and synthesis.

GC 3. Creativity, initiative, entrepreneurship and the ability to work in a team.

GC 6. Internal need for purposeful improvement of professional knowledge and skills during training and professional activity.

GC 7. Practical use of modern Ukrainian in the field of business and professional (scientific and technical) communication.

GC 8. Practical use of a foreign language in the social and professional fields of communication

PC 3. Ability to state and solve problems of product parameters designing and processes of their manufacturing;

Expected Learning Outcomes:

PLO 2. Assessment of modern processes and problems of social development from the standpoint of the natural science nature of society

PLO 4. Knowledge of modern information and communication technologies to the extent sufficient for training and professional activities.

PLO 9. Describe experimental methods for studying the structural, physical-mechanical and technological properties of materials, as well as non-destructive methods of quality inspection.

PLO 11. Awareness in the field of theoretical and instrumental support of interchangeability of parts, accuracy and quality of surface treatment of parts of Aerospace Technology.

PLO 12. To show abilities and skills concerning development of technological processes of production and a choice of technological equipment, calculation of need for materials for typical structural elements of aerospace technology assembly components.

In particular, the student should

know:

• terms and definitions of objects of study;

• the main factors influencing the technologies of aircraft manufacturing;

• composition, names and characteristics of aviation materials;

• the content of the main technological processes of aircraft manufacturing and equipment used.

• be familiar with general terms in the nomenclature of aviation materials and peciliarities of their application.

be able:

• to use the terminology of aircraft design, aviation complex and manufacturing technologies;

• to distinguish technological processes for the manufacturing of main parts by their features and assembly of different levels;

• to distinguish the objects of main and auxiliary production

Corequisites: Physics; Aviation Materials Science; Engineering Graphics; Aircraft Design, Technologies of Aircraft Manufacturing

3. The Content of the Discipline

Module 1.

Content Module 1. *Technological system of aviation manufacturing and technological preparation of production and repair of Aerospace Technology*

Topic 1. Product life cycle. System of production technologies of aviation production.

Product life cycle, its stages. The main sequence of transformations in the product life cycle. Production process – definition, structure. Technological and auxiliary processes. The concept of technological operation and technological transition. The structure of the production enterprise. Classification of materials and basic properties of materials. The concept of strength and ductility of materials. Materials used for aerospace technology: metals, plastics, structural composite materials, rubber, sealing materials. Inner structure of metals.

Topic 2. The system of technologies of the aviation complex (technologies of manufacturing, testing and repair of aircraft)

Features of aircraft as an object of production. Technological classification of aircraft parts - unit, compartment, unit, etc. (structural and technological division of aircraft). Assembly units and parts. Classification of production processes of an aviation enterprise: procurement and processing production, assembly of assemblies and units, general assembly of aircraft, quality control and testing. General composition of aerospace production processes: procurement and stamping processes, processing with chip removal, coating, nodal and aggregate assembly, general assembly and testing of aircraft. Reconstructions and purpose of distribution

processes in procurement and stamping production. Blanking and sheet metal stamping works: aircraft parts obtained by these methods, blanks for its, deforming methods, tools and equipment used. Forging production – blanks, basic operations, tools, equipment. Foundry (casting) production. Machining with chip removal: aircraft parts that receive by mechanical, electrical and electrochemical processing, types of workpieces, tools and equipment used. The concept of allowance for processing. Additive technologies and their influence on the design of the aircraft airframes. Prospects for their use in the production and repair of the aircraft. Thermal and thermochemical treatment of aircraft parts and coatings – purposes, methods, equipment used. The concept of the assembly process. Peculiarities of assemblig and mounting work in the aircraft manufacturing.

Topic 3. Technological preparation of manufacturing of Aerospace Technology.

Technological preparation for the aircraft manufacturing. Interchangeability, ways to ensure it in mechanical engineering and instrument making. Methods of ensuring interchangeability used in aerospace production. Purpose of lofts and templates. Methods of co-ordination of blanking and assembly tooling: traditional and modern ones. Using the computer-aided systems in the production of aircraft. Prospects for the improving the aerospace manufacturing.

Modular control

4. The Structure of the Discipline

The name of the content module and topics	Number of hours				
	Total	Including			
		Lect.	Pract.	Lab.	Ind. work
1	2	3	4	5	6
Module 1					
Content module 1. Professional design capabilities in SolidWorks CAD					
Topic 1. Product life cycle. System of production technologies of aviation production.	8	2	2		4
Topic 2. The system of technologies of the aviation complex (technologies of manufacturing, testing and repair of aircraft)	12	4	4		4
Topic 3. Creating and editing models of parts made of sheet material.	8	2	2		4
Modular control	2				2
Total hours on a Content Module	30	8	8		14
Total hours	30	8	8		14

5. Topics of seminars

#	Name topics	Number of hours
1	The curriculum does not provide	
	Total	

6. Topics of practical classes

#	Name topics	Number of hours
1	The curriculum does not provide	
1	Study of the general structure of technological processes of volume stamping and the applied equipment	2
2	Study of the composition of distribution technological processes of sheet metal stamping and applied equipment	2
3	Study of the composition of forming technological processes of sheet metal stamping	2
4	Study of the processes of assembling aircraft units.	2
	Total	8

7. Topics Of Laboratory Classes

#	Name topics	Hours
Content module 1.		
1	The curriculum does not provide	
	Total	

8. Independent Work

#	Name topics	Number of hours
1	History of technology development. History of the manufacturing and repair of aerospace technology	4
2	Technological equipment for forging processes and for sheet metal stamping - characteristics and fields of application	4
3	Methods and means of co-ordination used in aerospace production. Purpose of lofts and templates. Modern means of blanking and assembly tooling co-ordination	4
	Total	12

9. Individual tasks

10. Teaching methods

Verbal: story, explanation, educational discussion during lectures; **visual**: illustration and demonstration of presentations during lectures; **practical**: practical work.

11. Assessment Methods

During the study of the discipline, the following types of assessment are provided: current one, during lectures and practical classes; modular during the semester; final assessment in the form of a multi-choice options test.

12. Evaluation Criteria and Distribution of Points Received by Students

Components of academic work	Points for one class (task)	Number of classes (tasks)	Total points
Content module 1			
Activity on lectures	0..1	4	0..4
Performing and defense of laboratory (practical) works	0..1	4	0..4
Modular control	5..25		5..25
Total for the semester			**0…100**

The test for modular control consists of 25 questions with multi-choice options. The maximum score of points for one correct answer to the question is 1 point. During the discipline modular control of this module student can receive 25 points maximum

During the final assessment test, the applicant has the opportunity to receive 100 points maximum.

Criteria for evaluating student work during the semester

Satisfactory (60… 74). Having a minimum of knowledge and skills. Work out practical tasks. Be able to characterize independently the main composition of operations of modern technological methods of aircraft parts manufacturing, their assembly and technological preparation,

Good (75… 89). To know firmly and be able to perform the full range of tasks provided by the discipline. To work out all practical classes in the term stipulated by the teacher with the substantiation of the decisions and actions which are offered in works.

Excellent (90… 100). To know completely the basic and additional material of the discipline. Navigate in textbooks and manuals. Be able to determine independently the structural composition of the object of aerospace technology, as an object of manufacturing, as well as the sequence and main stages of its life cycle. Be able to determine the necessary technological transformations for the manufacture of the structural element of the aerospace technology. Unmistakably perform all tasks of practical classes within the period specified by the teacher with a detailed justification of the decisions and measures proposed.

Grading scale: point and traditional

Total points	Score on a traditional scale
90 - 100	Passed
75 - 89	
60 - 74	
0 - 59	Not Passed

13. Methodical support

1. https://mentor.khai.edu/course/view.php?id=4640

14. Recommended reading

Basic

1. Mikell P. Groover. Fundamentals of modern manufacturing. Materials, processes, and systems. John Wiley & Sons, Inc., USA, 1025 p.
2. Ajoy Kumar Kundu. Aircraft Design. Cambridge University Press, The Edinburgh Building, Cambridge CB2 8RU, UK. 650 p.

Auxiliary

1. Aircraft Design: Synthesis and Analysis. Desktop Aeronautics, P.O. Box 20384, Stanford, CA 94309. 580 pages

15. Information resources

1. Electronic Library of the National Aerospace University "KhAI": http://library.khai.edu.
2. https://t.me/aircraft_manufacturing
3. Electronic Library of the Dep. #104: \\domik\SHARED\Методические материалы_ENGLISH LITERATURE - Англоязычная литература__Introduction to Aircraft Engineering