Country	Institution	Internship on	ECTS
Poland	**Military University of Technology**	**Aerospace Technology**	**10**

Service **ALL**	**Minimum Qualification for Lecturers** • **Officers or civilian Lecturers:** ○ English: Common European Framework of Reference for Languages (CEFR) Level B2 or min. NATO STANAG 6001 Level 3. ○ Thorough knowledge of particular technologies in aerospace. ○ Adequate knowledge of new trends in research and study on new technologies in aerospace.
Language **English**	

Prerequisites for international participants:	**Goal of the Module**
• English: Common European Framework of Reference for Languages (CEFR) Level B1 or NATO STANAG Level 2. • At least 1 year of national (military) higher education. • Students with aerospace technology background.	• Deepen knowledge of aeronautics and astronautics technologies in terms of avionics systems, aircraft construction and maintenance. • Discover and understand the practical applications of technologies in aeronautics and astronautics, including avionics systems, aircraft construction and maintenance, and other mechatronic systems. • Learn theoretical aspects of control and measurement systems, sensors and actuators, construction of the airframe, propulsion system, aircraft maintenance procedures. • Discover and understand the practical application of technologies in aeronautics and astronautics, including avionics systems, aircraft construction and maintenance.

Learning outcomes		
	Know-ledge	• Formulate fundamentals of the control and measurement systems analysis; • Define the basic operation of sensors and actuators; • Perform the mathematical description and simulation analysis; • Explain the fundamental procedures of aircraft maintenance; • Discuss the technologies applied in the area of aircraft manufacturing and repairing; • Summarize the construction and assembling of airframe parts and aircraft propulsion system components; • Describe the rules of constructing and assembling airframe parts and aircraft propulsion; • Interpret the necessary terminology allowing him/her to express opinion, arguments, and feedback on aerospace technology to be used within particular systems;
	Skills	• Demonstrate ability to design computer models in MATLAB software with the use of some toolboxes; • Demonstrate ability to rapid prototype by using the LabVIEW software; • Demonstrate ability to elaborate laboratory models and some elements; • Demonstrate ability to analytical calculations in areas of aerodynamics and strength of thin-walled structure; • Demonstrate ability to model simple structural elements in an advanced CAD/CAE environment; • Demonstrate ability to do FEM analysis of simple structural elements; • Demonstrate ability to apply Reverse Engineering in recreating structural element geometry.
	Respon sibility and autono my	• Perform practical work for application of particular technologies in aerospace; • Suitably use adequate tools for respective maintenance of the aircraft; • Examine and correctly assess the trends in the development of the new technologies in aerospace and their potential future application.

Created by LtCol K. Wojtowicz, PhD, LtCol M. Henzel, PhD ..... 11th of May, 2022
Revised by Col Assoc. Prof. H. Gell, PhD (Chairman IG) ..... 22th of May, 2022
Revised by Capt. (N) Assoc. Prof. N. Dimitrov, PhD ..... 23th of May, 2022

Evaluation of learning outcomes

- **Observation**: Throughout the Module students will meet with the aerospace technologies applications, and they will discuss the given topics in the plenary and present teamwork results. During this work, students will be evaluated to verify their competencies.
- **Interim tests**: Oral or written exams at the end of submodules.
- **Final Test**: Oral exam at the end of the module.

Module Details

Main Topic	Recom-mended WH	Details
Fundamentals of control theory	24	• Mathematical models of control systems; • Performances and quality of the control systems; • Designing of the controller; • Definition of control, the structure of control systems, classification of signals and control systems; • Definition of control quality functions, disturbance rejection, stability term, stability criteria, quality parameters in time and frequency domains; • Controller description, type of controllers, and parameters of the control systems.
PCBs design methodology	24	• The design and analysis of electrical circuits by using the Altium Designer software; • Starting a new Altium Project; • Installing and using libraries in Altium; • Placing components in schematics; • Components properties and inserting points; • Pushing footprints to PCB; • Design rule checks.
Rapid prototyping in LabVIEW software	24	• Basics programming in LabVIEW software; • Configuration of hardware unit in LabVIEW software; • Control system applications (2-DOF Helicopter, giro-stable platform); • Measurement application (magnetometer).
Fundamentals of aircraft designing.	24	• Application of FEA techniques for structural strength and dynamics (MSC Software); • Simulation of strain and stress distribution for specific load cases of one-dimensional structural element; • Simple tubular rod loaded with an axial force; • Simple tubular cantilever beam loaded with a torsional moment; • Simple tubular cantilever beam loaded with transverse energy; • Simple cantilever beam with three load components at once.
Modelling and reconstruction of airframe structure	24	• Using advanced CAD environment (Siemens NX) for airframe modelling; • Create a new drawing; • Setup units of measure: metric or imperial system; • Copy and move objects within and between drawings; • Apply the coordinate system; • The essential application of CAD operating techniques: sketching, generating surfaces, extruding solids, and body assembling.

		• Simulation of strain and stress distribution for specific load cases of the one-dimensional structural element; • Simple tubular rod loaded with an axial force, tubular cantilever beam loaded with a torsional moment and with transverse energy;
Construction, design and calculations for different aircraft engines.	24	• Fundamentals of design and calculation for different aircraft engines • Using an advanced CAD environment
Some issues of aircraft maintenance	24	• Practical maintenance in the airshed; • Selected technical aspects of the maintenance of some aircraft; • Operational checkouts of selected aircraft; • Some issues of airframe and aircraft engine maintenance.
Fundamentals of design, manufacture and maintenance of the mechatronic system	24	• Fundamentals of design, manufacture and maintenance of the mechatronic system; • Fundamentals of CNC machining;
Fundamentals of CNC machining	6	• Demonstration exercises at the Laboratory of CNC Machining
Fundamentals of avionics systems	6	• Demonstration exercises at the Simulators Workshop, Laboratory of Avionics.
Fundamentals of aerospace construction technologies	6	• Demonstration exercises on civilian and military aircraft.
Fundamentals of air armament systems	6	• Demonstration exercises at the Laboratory of Air Armament.
Fundamentals of aerodynamics	6	• Demonstration exercises at the Laboratory of Aerodynamics.
Fundamentals of thermodynamics	6	• Demonstration exercises at the Laboratory of Thermodynamics.
Fundamentals of robotics	6	• Demonstration exercises at the Laboratory of Automatics and Robotics.
Some issues of special military systems construction	6	• Demonstration exercises at the Small Arms Workshop and Artillery Workshop, Laboratory of Special Constructions.
Total	**240**	
Additional hours (WH) to increase the learning outcomes		
Self-Studies	60	• Separate hours for in-depth-studies on an as-required basis; • Those hours comprise work of students in laboratories and exercises to improve skills and consolidate knowledge.
Total WH	**300**	**Remarks:** • The module encourages the active participation of students; • The detailed amount of hours for the respective main topic is up to the course director according to national law or home institution's rules.

List of Abbreviations:

B1, B2 ..... Common Reference Levels
CEFR ..... Common European Framework of Reference for Languages
Col ..... Colonel
Doc. ..... Document
e. g. ..... exempli gratia (for example)
ECTS ..... European Credit Transfer and Accumulation System
ESDC ..... European Security and Defence College
IG ..... Implementation Group
LtCol ..... Lieutenant Colonel
NATO ..... North Atlantic Treaty Organization
PhD ..... Doctor / Doctor of Philosophy
PL ..... Poland
STANAG ..... Standardization Agreement
WH ..... Working Hour / Working Hours