Country	Institution	Internship on	ECTS
Poland	**Military University of Technology**	**Aerospace Technology**	**8**

Service	**Minimum Qualification for Lecturers**
ALL	• **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.	• General knowledge of aeronautics and astronautics technologies in terms of avionics systems, aircraft construction and maintenance. • Practical application of technologies in aeronautics and astronautics including avionics systems, aircraft construction and maintenance. • Theoretical aspects of control and measurement systems, sensors and actuators, construction of the airframe, propulsion system, procedures of aircraft maintenance.

Learning outcomes		
	Know-ledge	• Knows fundamentals of the control and measurement systems analysis; • Knows the basic operation of sensors and actuators; • Knows the mathematical description and simulation analysis; • Knows the fundamental procedures of aircraft maintenance; • Knows the technologies applied in the area of aircraft manufacturing and repairing; • Understands the rules of constructing and assembling of airframe parts and aircraft propulsion system components; • Demonstrates the necessary terminology allowing him/her to express opinion, arguments, and feedbacks on aerospace technology to be used within particular systems;
	Skills	• Is able to design of computer models in MATLAB software with the use of some toolboxes; • Is able to rapid prototype by using the LabVIEW software; • Is able to elaborate laboratory models and some elements; • Is able to do analytical calculations in areas of aerodynamics and strength of thin-walled structure; • Is able to model simple structural elements in advanced CAD/CAE environment; • Is able to do FEM analysis of simple structural elements; • Is able to apply techniques of Reverse Engineering in recreating structural element geometry.
	Respon sibility and autono my	• Argues the necessity of the application of particular technologies in aerospace; • Argues the suitability of usage of adequate tools for respective maintenance of the aircraft; • Analysis the trends in development of the new technologies in aerospace and their potential future application.

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Revised by Col Assoc. Prof. Gell, PhD (Chairman IG) ..... DDth of June, 2020
Revised by LtCol Spinello (Chairman LoD 8) ..... DDth of June, 2020
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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 these work students will be evaluated to verify their competences.
- **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	16	• 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 criterions, quality parameters in time and frequency domains; • Controller description, type of controllers, parameters of the control systems.
Design and simulation of mechatronic systems using the MATLAB-Simulink software	16	• Design and analysis of control and measurement components using the MATLAB software; • Elaboration of computer model in MATLAB software using some toolboxes (e.g. Control System Toolbox, Simscape Toolbox, Simulink 3D animation).
PCBs design methodology	16	• 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	16	• Basics programming in LabVIEW software; • Configuration of hardware unit in LabVIEW software; • Control system applications (2-DOF Helicopter, giro-stable platform); • Measurement application (magnetometer).
Modelling and reconstruction of airframe structure	16	• 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, body assembling.
Fundamentals of aircraft designing	16	• 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;

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		• 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.
Some issues of airframe aircraft maintenance	16	• 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 engines maintenance.
Some issues of aeronautics and astronautics technologies	16	• Presentation of new aerospace technologies; • Advanced laboratory stands; • Modern aircraft structures; • Advanced measurement methods.
Fundamentals of flight simulators	4	• Demonstrational exercises at the Simulators Workshop, Laboratory of Avionics.
Fundamentals of aerospace construction technologies	4	• Demonstrational exercises on the civilian and military aircraft.
Fundamentals of aerodynamics and thermodynamics	4	• Demonstrational exercises at the Laboratory of Aerodynamics and Thermodynamics.
Fundamentals of air armament systems	4	• Demonstrational exercises at the Laboratory of Air Armament.
Fundamentals of robotics	4	• Demonstrational exercises at the Laboratory of Automatics and Robotics.
Fundamentals of design, manufacture and maintenance of mechatronic system	4	• Demonstrational exercises at the Laboratory of CAX.
Some issues of constructions of special military systems.	4	• Demonstrational exercises at the Small Arms Workshop and Artillery Workshop, Laboratory of Special Constructions.
Total	**156**	
Additional hours (WH) to increase the learning outcomes		
Self-Studies	44	• 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	**200**	**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