Countries	Institutions	Common Module	ECTS
Romania **Poland** **Greece** **France** **Bulgaria**	Military Technical Academy "Ferdinand I" Military University of Technology Hellenic Air Force Academy French Air Force Academy "Vasil Levski" National Military University	**Applied Informatics** *European Common Technical Semester for Defence and Security*	**3.0**

Service	**Minimum Qualification of Instructors**
Technical/ALL	• **Officers or civilian Lecturers:** ○ English: Common European Framework of Reference for Languages (CEFR) Level B2 or min. NATO STANAG 6001 Level 3. ○ Expertise in relevant topics. ○ Relevant academic publications.
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. • Basic knowledge in technical systems for security and defence	• Basic concepts of programming language techniques for defence and security technology applications. • Concepts and constructions across programming languages. • Computer-based problem-solving methods applied in defence and security technology systems.

Learning outcomes		
	Know-ledge	• Describe the basic concept of programming languages applied in defence and security technology applications. • Identify the main algorithms and programming language techniques used to solve the basic applications in defence and security technology systems.
	Skills	• Design, implement and debug simple programs for modelling and simulation of basic defence and security phenomena. • Apply programming languages algorithms to solve basic defence and security technology applications.
	Respon-sibility and autonomy	• Analyse and check the correctness and quality of the algorithms and computer codes. • Compare different programming language techniques to better solve applications in the defence and security technology field.

Verification of learning outcomes:

- **Observation**: Students are evaluated during each session, in order to document their understanding of the basic concept of programming languages applied in defence and security technology applications
- **Project**: Teamwork project and project defence.
- **Test**: Final examination at the end of the module.

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Module details		
Main Topic	**Recom-mended WH**	**Details**
Basic of programming languages	4	**Lecture (2h) and Applications (2h):** - Data types. The concept of variables and declarations in programming languages. - Mathematical operations with arrays, vectors, and matrices. - Functions and libraries. User-defined functions.
Algorithmization of data processing tasks	4	**Lecture (2h) and Applications (2h):** - Concept, classification, and methods of description of algorithms. - Controlling the flow of information in the algorithm. - Iterative algorithms: Iterative algorithms: Program loop: loops with and without a counter. Iterative processing principle - Principle of recursive processing and constructing an algorithm: main segment and subroutines. - Checking the correctness of the algorithm: tree of consecutive calls and returns, using the stack properties.
Graphical representation of data	4	**Lecture (2h) and Applications (2h):** - Plotting in two dimensions and three dimensions. - GUI design.
Numerical Integration of Ordinary Differential Equations with MATLAB	8	**Lecture (4h) and Applications (8h):** - Initial value problem. Runge-Kutta method. - Solving ODE with MATLAB. - Solving a second order ODE. - Modelling of Bullet Trajectory.
Numerical Integration of Ordinary Differential Equations with SIMULINK	8	**Lecture (2h) and Applications (8h):** - Solving ODE with SIMULINK. - Solving a second order ODE. - Modelling of Bullet Trajectory.
Using specific MATLAB toolboxes	8	**Lecture (2h) and Applications (6h):** - Structural analysis with MATLAB.
Total WH	**42**	
Additional hours (WH) to increase the learning outcomes		
Self-Studies and syndicate work	33	• Enhancing knowledge by studying specific documents. • Preparation for the group project. • Teamwork for the group project. • Those hours comprise the work of students in laboratories and exercises to improve skills and consolidate knowledge.
Total WH	**75**	

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BIBLIOGRAPHY:

1. William Bober, *Introduction to Numerical and Analytical Methods with MATLAB for Engineers and Scientists,* CRC Press Taylor&Francis Group, 2014;
2. Ranjan Parekh, *Fundamentals of Graphics Using MATLAB,* CRC Press Taylor&Francis Group, 2020;
3. William J. Palm III, *Introduction to MATLAB for Engineers,* McGraw-Hill, 2005;
4. Shampine L.F., Gladwell I., Thompson S., *Solving ODEs with MATLAB,* Cambridge University Press, 2003;
5. Yogesh Jaluria, *Computer Methods for Engineering with MATLAB Applications,* CRC Press Taylor&Francis Group, 2011
6. Anders Malthe Sørenssen, *Elementary Mechanics Using MATLAB. A Modern Course Combining Analytical and Numerical Techniques,* Springer, 2015
7. Individual materials of the lecturer

List of Abbreviations:

B1, B2 ..... CEFR Levels

CEFR ..... Common European Framework of Reference for Languages

ECTS ..... European Credit Transfer and Accumulation System

GUI ..... Graphical User Interface

ODE ..... Ordinary Differential Equations

WH ..... Working Hour

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