

Common Module **Programming Languages** Module Description

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	Programming Languages <i>European Common Technical</i> <i>Semester for Defence and Security</i>	3.0

Service	Minimum Qualification of Instructors	
Technical/ALL	Officers or civilian Lecturers:	
Language English	 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. 	

Prerequisites for international participants

- ٠ 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

Goal of the Module

- Discover and understand the programming languages.
- Basic concepts of principles of object oriented programming ٠ for defense and security technology.
- Concepts and constructions object oriented across programming languages.

mes	Know- ledge	 Describe the basic principles of object oriented programming applied in defense and security technology. Identify the main concepts and algorithms used in object oriented programming in order to solve the basic applications in defense and security technology.
rning outco	Skills	 Design, implement and debug simple object oriented programs for modelling and simulation of basic defense and security. Apply object oriented programming languages algorithms to solve basic defense and security technology applications.
Lea	Respon- sibility and autonomy	 Analyze and check the correctness and quality of the object oriented algorithms and codes. Compare different object oriented programming language techniques to better solve applications in the defense and security technology field.

Verification of learning outcomes:

- Observation: Throughout the Module students will meet with the systems applications, and they will ٠ discuss the given topics in the plenary and present teamwork results. During this workshop, students will be evaluated to verify their competencies.
- **Project**: Teamwork project and project defence.
- Test: Final examination at the end of the module.

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Page 1 of 3

30 06 2023



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Module details						
Main Topic	Recom- mended WH	Details				
Basic of programming languages	6	 Lecture (2h) and Applications (4h): Data types. The concept of variables and declarations in programming languages. Mathematical operations with arrays, vectors, and matrices. Functions and libraries. User-defined functions. 				
Classes and Objects	6	 Lecture (2h) and Applications (4h): Object oriented programming. Basic principles of object oriented programming. Class declaration: access-modifiers, member-variable, member-function. Defining a method outside the class. Objects, Object pointers, Arrays of objects. 				
Class constructors and destructors	6	Lecture (2h) and Applications (4h): - Constructor and destructor. - Constructor Definition. - Default Constructor. - Parameterized Constructor. - Copy Constructor. - Destructor Definition.				
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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Page 2 of 3







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BIBLIOGRAPHY:

1. Stroustrup B, The C++ Programming Language (4th Edition), Addison-Wesley, ISBN 978-0321563842. May 2013.

2. Stroustrup B., A Tour of C++ (3rd Edition). Addison-Wesley. ISBN-10: 0-13-681648-7 ISB-13: 978-0-13-681648-5 September 2022.

3. Stroustrup B., *Programming -- Principles and Practice Using C++ (Second Edition)*. Addison-Wesley. ISBN 978-0321992789. May 2014.

4. Lippman S., Lajoie J., Moo B., C++ Primer (Fifth Edition), Addison-Wesley, ISB-13: 978-0-32-171411-4. August 2012.

List of Abbreviations:

CEFR Levels	B1, B2
Common European Framework of Reference for Languages	CEFR
European Credit Transfer and Accumulation System	ECTS
Working Hour	WH

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