



## COURSE UNIT (MODULE) DESCRIPTION

Course unit (module) title	Code
<b>OPERATING SYSTEMS AND THEIR SECURITY</b>	

Academic staff	Core academic unit(s)
<b>Coordinating:</b> Martas Ambraziūnas	Vilnius University, Kaunas Faculty Muitinės str.. 8, LT-44280, Kaunas

Study cycle	Type of the course unit
I (first)	Compulsory

Mode of delivery	Semester or period when it is delivered	Language of instruction
Auditoria/Remote	2	Lithuanian/English

Requisites	
<b>Prerequisites:</b> Computer Architecture	<b>Co-requisites (if relevant):</b>

Number of ECTS credits allocated	Student's workload (total)	Contact hours	Individual work
5	130	52	78

Purpose of the course unit
To acquaint students with basic OS concepts and functions including control over software and hardware. Learn to monitor OS performance as well as automated tasks using different tools and scripting languages.

Learning outcomes of the course unit	Teaching and learning methods	Assessment methods
Knowledge about PC hardware interaction with software and main role of OS in this process. Ability to monitor and interact with OS using build-in terminal (console) environments (Powershell, Bash) and .Net languages (F#,C#) as well as third party tools.	Lectures, exercises, individual work	Lab exercises Synopses Midterm Exam Exam
Ability to understands computer architecture (hardware and software elements and relationships between them).	Lectures, exercises, individual work	Lab exercises Synopses Midterm Exam Exam
Ability to analyse IT-related problems, propose and apply secure (from a cybersecurity perspective) information system solutions in practice.	Lectures, exercises, individual work	Lab exercises Synopses Midterm Exam Exam
Ability to understands the principles of human-computer interaction and apply this knowledge theoretically and practically to develop software applications.	Lectures, exercises, individual work	Lab exercises Synopses Midterm Exam Exam

Content	Contact hours							Individual work: time and assignments	
	Lectures	Tutorials	Seminars	Workshops	Laboratory work	Internship	Contact hours, total	Individual work	Tasks for individual work
Definition of computer system, its elements and functions. Definition of OS its functions and elements. OS efficiency criteria and classification. Major families of OS.	2			2			4	6	Literature studies; preparation for midterm exam lab exercises;
Introduction to Windows Powershell scripting language: main concepts, syntax and use cases.	2			2			6	6	synopses presentations
Definition of Bus and its functions in computer system. Bus types and hierarchies. Bus arbitration and Bus arbiter.	2			2			5	5	preparation for exam
Definition of CPU and its functions as well as internal structure. Moore's Law. CPU data flows. Instruction cycle and pipelining. Machine code and assembly code.	2			2			5	5	
Definition of memory in computer system and its functions. Main memory characteristics and memory hierarchy. RAM and ROM memory. Storage or secondary memory. Cache memory architecture.	2			2			5	5	
Introduction to .Net F# programming/scripting language and .Net libraries that are used for processes, services, logs information acquisition (including VMI).	2			2			6	6	
Definition of Input/Output (I/ O) system and its functions. I/O device structure. I/O module and I/O operation types.	2			2			5	5	
Memory management. OS memory management functions. Memory allocation methods. Memory fragmentation and defragmentation. Virtual memory. Memory address types.	2			4			7	7	
Process management. Process states and processes queue (scheduling algorithms). Process descriptor and context. Process synchronization and interaction. A critical section and deadlocks. Threads (thread).	2			2			5	5	
Introduction to Bash (Unix Shell). Main language concepts, syntax and use cases.	2			4			6	6	
File system. The file system attributes. Access to file legislation. Global file system model. Modern file systems architecture.	2			2			5	5	
OS security. Types of OS security breaches and threat sources. Countermeasures: authentication, authorization, cryptography, security procedures.	2			2			5	7	
<b>Total:</b>	24			28			52	78	

Assessment strategy	Weight %	Deadline	Assessment criteria
Lab. exercise 1	10 %	3 week.	Exercise with Windows OS monitoring tools (Sysinternals) and selected third party monitoring software. Assessed in grades 1-10 based on quality of implementation and delivery time.
Lab. Exercise 2	10 %	5 week.	Exercise with Windows Powershell (Basic operations, process management). Assessed in grades 1-10 based on quality of implementation and delivery time.
Lab. Exercise 3	10 %	7 week.	Exercise with Windows Powershell (services and registries management, logs monitoring, scheduled tasks). Assessed in grades 1-10 based on quality of implementation and delivery time.
Lab. exercise 4	10 %	8-11 week.	Exercise with .Net F#. Assessed in grades 1-10 based on quality of implementation and delivery time.
Midterm exam	15%		Ten open questions from theoretical part. Assessed in grades 1-10
Lab. Exercise 5	10 %	9 week.	Exercise with .Net C#. Assessed in grades 1-10 based on quality of implementation and delivery time.
Lab. Exercise 6	10 %	11 week.	Exercise with Unix Bash (Basic operations). Assessed in grades 1-10 based on quality of implementation and delivery time.
Synopsis	10 %	During semester	Investigation and presentation of selected OS and its security flows and issues.
Exam	15%	Session	Esay about OS and Cyber security
AI usage			Usage of these tools is not restricted in this course and might be used by the students in order to help to solve complex tasks and make efforts more efficient.
A student who (1) <b>throughout the semester consistently</b> fails to demonstrate <b>progress in achieving the expected learning outcomes of a subject (module)</b> during the practical classes (seminars, exercises, laboratory work, etc.) and (2) fails to complete all interim assessment requirements and tasks within the time specified in the course description, is not allowed to participate in the examination session			

Author (-s)	Publishing year	Title	Issue of a periodical or volume of a publication	Publishing house or web link
<b>Required reading</b>				
Martas Ambraziūnas	2025	Operating systems and their security		<a href="https://emokymai.vu.lt/">https://emokymai.vu.lt/</a>
Silberschatz, Abraham, Galvin, Peter B., and Gagne, Greg	2018	Operating System Concepts		Hoboken [N.J.]: Wiley
Tanenbaum, Andrew S & Bos, Herbert	2015	Modern Operating Systems		Boston [Mass.]: Pearson
<b>Recommended reading</b>				
Stallings, William Walter	2018	Operating Systems: Internals and Design Principles		Harlow: Pearson
Russinovich, Mark E. Solomon, David A.	2012	Windows Internals		Redmond [Wash.]: Microsoft Press
Love, Robert.	2004	Linux Kernel Development		Indianapolis [Ind.]: Sams Publishing