Course unit title	Course unit code
OPERATING SYSTEMS AND THEIR SECURITY	

Lecturer (s)	Department where course unit is delivered
Dr Martas Ambraziunas	Vilnius University, Kaunas Faculty Muitinės str.. 8, LT-44280, Kaunas

Cycle	Level of course unit	Type of the course unit
I (first)	1/1	Compulsory/Individual Studies

Mode of delivery	Semester or period when the course unit is delivered	Language of instruction
Auditoria/Remote	Spring semester	Lithuanian/English

Prerequisites and corequisites	
Prerequisites: Computer Architecture	**Corequisites:**

Number of ECTS credits allocated	Student ‘s workload	Contact work hours	Individual work hours
5	130	52	78

Purpose of the course unit: programme competences to be developed		
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. Separate note about LLMs. Usage of these tools is not restricted in this course and should be followed by principle „specialists who do not use AI will be replaced by those who do“ i.e. it should help students to solve complex tasks by making the efforts more efficient.		
Learning outcomes of 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 understanding the domain of information engineering.	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
Ability maintain and improve professional competence in computer engineering and cybersecurity by acknowledging with latest research data necessary for studies and work.	Lectures, exercises, individual work	Lab exercises Synopses Midterm Exam Exam
Ability to take initiative, plan and effectively carry out professional activities in both local and international contexts. Critically evaluate available resources (time, human, infrastructure, etc.) for solving tasks and problems that might arise.	Lectures, exercises, individual work	Lab exercises Synopses Midterm Exam Exam

Course content: breakdown of the topics	**Contact work hours**							**Individual work hours and tasks**	
	Lectures	Seminars	Practice classes	Laboratory	Consultation	Practice	**All contact work**	**Individual work**	**Tasks**
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; synopses presentations preparation for exam
Introduction to Windows Powershell scripting language: main concepts, syntax and use cases.	2			2			6	6	
Definition of Bus and its functions in computer system. Bus types and hierarchies. Bus arbitration and Bus arbiter.	2			2			5	5	
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 thread sources. Countermeasures: authentication, authorization, cryptography, security procedures.	2			2			5	7	
Total:	24			28			52	78	

Assessment strategy	**Comparative weight percentage**	**Date of examination**	**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	Ten open questions theoretical part. Assessed in grades 1-10

Author	**Year**	**Title**	**Number of periodical publications or publication Volume**	**The place of publication and publisher or online link**
Required reading				
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
Recommended reading				
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