

I067	Operating systems	L	P	S	ECTS 8
		3	2	1	

Course objectives. To define basic concepts and principles of the modern operating systems. To introduce the problematics of multi-threaded and multi-process computing, virtual memory, file system, input, output and interrupts. Students will gain an insight into modern concepts of virtualization, multi-processor and distributed systems as well as cloud-based systems. The notion of security will be introduced and put into the context of modern operating systems. Above mentioned concepts will be implemented and studied on the examples of real operating systems.

Prerequisites. Undergraduate computer science course.

Course content.

1. Introduction. Brief history of hardware and operating systems. Basic concepts and structures of operating systems.
2. Threads and processes. Implementation and manipulation. Inter-thread and inter-process communication. Scheduling. Shared memory.
3. Memory. Address space. Virtual memory. Page file and accompanying concepts. Implementation and algorithms.
4. File system. Files and folders. Implementation. Optimization and management of the file system.
5. Input and output. Hardware and software background. Controller programs. Disks.
6. Interrupts and deadlocks. Deadlock detection and recovery. Avoiding and preventing deadlocks.
7. Virtualization and cloud. Virtualization techniques. Virtualization of input, output and memory. Virtualization on multi-processor systems. Cloud.
8. Multi-processor systems. Distributed systems.
9. Operating system security. Access control. Formal models. Authentication. Attacks, computer viruses and protection.

LEARNING OUTCOMES

No.	LEARNING OUTCOMES
1.	To explain the basic concepts of operating systems.
2.	To define and implement the concepts related to threads and processes and to use them in a real operating system.
3.	To define an address space and virtual memory and to implement the algorithms applied to the page file.
4.	To explain and implement the basic principles of the file system.
5.	To compare the input and output device in the context of operating systems and to explain the accompanying controller programs.
6.	To analyze the reasons and to define the methods of avoiding deadlocks.
7.	To define the advanced concept of virtualization, cloud, multi-processor and distributed systems and to analyze their application in the context of the modern operating systems.
8.	To analyze the problems and the solutions to the operating system security.
9.	To define and explain the formal security model.

RELATING THE LEARNING OUTCOMES, ORGANIZATION OF THE EDUCATIONAL PROCESS AND ASSESSMENT OF THE LEARNING OUTCOMES

TEACHING ACTIVITY	ECTS	LEARNING OUTCOME **	STUDENT ACTIVITY*	EVALUATION METHOD	POINTS	
					min	max
Attending lectures and exercises	1	1-9	Lecture attendance, discussion, team work and individual work on given assignments	Attendance lists, tracking activities, closed for assignments	0	10
Homework	3	1-9	Individual solving of assignments	Evaluation	40	60
Final project	4	1-9	Revision and literature review	Evaluation	10	30
TOTAL	8				50	100

Teaching methods and student assessment. Lectures and exercises are obligatory. The exam consists of a written and an oral part which are taken after all the lectures are done. Successful homework results, done during the semester, and an acceptable final project, done after all of the lectures, may replace the written exam. Practices are partly auditory and partly done in the computer lab.

Can the course be taught in English: Yes

Basic literature:

1. A. S. Tanenbaum, H. Bos, Modern operating systems, 4th edition, 2014.

Recommended literature:

1. A. Silberschatz, Operating system concepts, Wiley, 10th edition, 2017.
2. R. H. Arpaci-Dusseau, A. C. Arpaci-Dusseau, Operating systems: three easy pieces, CreateSpace Independent Publishing Platform, 1st edition, 2018.