

Course Specification Document

Title	Fundamentals of Operating Systems
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Credits	5 ECTS
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Aims	This course aims explain the basic concepts and principles of computer operating systems and to create a clear picture of their structure and internal working mechanism, which enables the student to develop applications that make optimal use of these systems.
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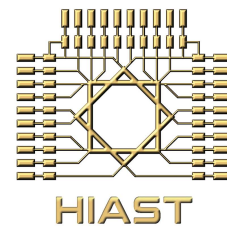
Intended learning outcomes

On successful completion of this course, the student will be able to:

- Understand the relationship between the computer system components and the operating system, and the mechanism of booting the system.
- Describe the basic components of operating systems and explain their working mechanism and the functions they provide.
- Explain the necessity of hardware protection for the proper work of the operating system.
- Understand how system resources and its major components are managed: processes and threads, main memory, virtual memory, secondary storage and the file system.
- Recognize the working principle of virtual machines and explain the difference between them.
- Analyze the performance of the operating system and optimally use the computer system.
- Exploit the processes and management tools provided by the system.
- Program multi-process and multi-threads applications.
- Efficiently use the computer system.

Syllabus

- **Introduction:** A brief history of the computers and the operating systems, types of operating systems and their characteristics.
- **Computer System structure:** General computer structure how does the CPU work, interrupts, input/output structure, storage structure, hardware protection.
- **Operating system structure:** Operating system components, system calls, system programs, system software structure, system design, implementation and generation, virtual machines.
- **Input/output system:** Input/output hardware, applications input/output interface, input/output kernel subsystem.
- **Processes:** Process concept, scheduling of the processes and scheduling algorithms, processes creation and termination, threads.
- **Interprocesses communication and synchronization:** Interprocesses communication (communication using shared memory, communication using the messaging system),



interprocesses synchronization (the race condition, critical section, mutual exclusion, deadlocks).

- **Memory management:** Multistep processing of a program, addresses binding, logical and physical addresses, swapping, memory allocation (contiguous allocation, paging, virtual memory).
- **File System:** File concept and file system, file structure types, attributes and operations, directory structure, organization and operations, mounting file system, file system implementation (Introductory example, physical structure, virtual file system, files and directories implementation, allocation method and free space management), efficiency and performance, journaled file system.
- **Practical sessions:**
 - **Linux system:** A reminder of system installation and use.
 - **Processes:** Process management in Linux and Windows.
 - **Threads:** Thread creation in Windows, Linux and Java.
 - **Communication between processes and threads:** Shared memory, pipes, messages.