

Course Unit	Operating Systems		Field of study	Network and Computer Systems	
Bachelor in	Informatics and Communications		School	School of Public Management, Communication and Tourism	
Academic Year	2023/2024	Year of study	1	Level	1-1
Type	Semestral	Semester	2	ECTS credits	6.0
Workload (hours)		162		Contact hours	
		T	-	TP	30
		PL	30	TC	-
		S	-	E	-
		OT	20	O	-
<small>T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other</small>					

Name(s) of lecturer(s)

### Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. Know the fundamental principles of the architecture and operation of modern operating systems
2. Master a set of basic concepts and techniques on system-level programming, using Linux as reference environment

### Prerequisites

Before the course unit the learner is expected to be able to:

1. Know how to program in a language with support to system-level programming (preferably C)
2. Master fundamental concepts on Computer Architectures

### Course contents

Introductory Concepts, Operating System Structures, Processes, CPU Scheduling, Process Synchronization, Main Memory, Virtual Memory, File-System. System-Level Programming in Linux.

### Course contents (extended version)

1. Introductory Concepts
  - Operating System Concept
  - Computing System Operation
  - Hardware Protection
  - Specialised Systems and Environments
2. Operating System Structures
  - System Services
  - User Interfaces
  - System Calls
  - System Programs
  - System Design and Implementation
  - Operating System Structure
  - System Generation
3. Processes
  - Process Concept
  - Process Scheduling
  - Operations on Processes
  - Interprocess Communication
  - Client-Server Communication
4. CPU Scheduling
  - Basic Concepts
  - Scheduling Criteria
  - Scheduling Algorithms
  - Scheduling in Multiprocessor Systems
  - Scheduling in Real-Time Systems
5. Process Synchronization
  - Basic Concepts
  - The Critical-Section Problem
  - Peterson's Solution
  - Synchronization Hardware
  - Locks and Semaphores
  - Classical Problems of Synchronization
6. Main Memory
  - Basic Concepts
  - Address Binding
  - Swapping
  - Contiguous Allocation
  - Paging
  - Segmentation
7. Virtual Memory
  - Demand Paging
  - Copy-on-Write
  - Page Replacement
  - Allocation of Frames
  - Thrashing
8. File-System
  - File-System Architecture
  - File-System Implementation
  - Allocation Methods
  - Free-Space Management
  - Efficiency and Performance
  - Recovery
9. System-Level Programming in Linux
  - Process Management
  - Files and Pipes
  - Shared Memory
  - Semaphores

**Recommended reading**

1. Silberschatz, A. , Galvin, P. B. , & Gagne, G. (2018). Operating system concepts (10th ed). Hoboken, NJ: John Wiley & Sons. ISBN: 978-1-119-32091-3
2. Silberschatz, A. , Galvin, P. B. , & Gagne, G. (2015). Fundamentos de sistemas operacionais (9a. ed. ). Rio de Janeiro: Grupo Gen - LTC. ISBN: 978-8521629399
3. Curso "Sistemas Operacionais e Você: Tornando-se um Usuário Avançado - Google", plataforma Coursera, 2024
4. Curso "Fundamentos de sistemas operacionais - Akamai", plataforma Coursera, 2024
5. Curso "Programa de cursos integrados Programação C com Linux - Institut Mines-Télécom", plataforma Coursera, 2024

**Teaching and learning methods**

The unit will be primarily taught using lectures that alternate the exposition of theoretical concepts with the resolution of exercises, complemented by practical works (optional) to be solved outside classes. All documentation (slides, exercises, solutions, assignments) will be provided through e-learning facilities.

**Assessment methods**

1. Alternative 1 - (Regular, Student Worker) (Final)
  - Intermediate Written Test - 30% (First Intermediate Test: theoretical part 1 (units 1 and 2) + practical part 1 (unit 9. a))
  - Intermediate Written Test - 35% (Second Intermediate Test: theoretical part 2 (units 3 , 4 and 7) + practical part 2 (unit 9. b))
  - Final Written Exam - 35% (First call Exam: theoretical part 3 (units 5 and 6) + practical part 3 (units 9. c and 9. d))
2. Alternative 2 - (Regular, Student Worker) (Supplementary)
  - Final Written Exam - 100% (Second call Exam: structured in the same 6 parts of the intermediate tests and normal epoch exam)
3. Alternative 2 - (Regular, Student Worker) (Special)
  - Final Written Exam - 100% (Exam on all topics subject to evaluation, without reusing any previous grades)

**Language of instruction**

Portuguese

**Electronic validation**

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28-03-2024	04-04-2024	04-04-2024	06-04-2024