INSTITUTO POLITÉCNICO DE BRAGANÇA

Course Unit	Computer Architecture and Operating Systems			Field of study	Computer Engineering		
Bachelor in	Management Informatics			School	School of Technology and Management		
Academic Year	2022/2023	Year of study	1	Level	1-1	ECTS credits	6.0
Type	Semestral	Semester	1	Code	9186-709-1104-00-22		

Workload (hours)	162	Contact hours	T -	TP 60	PL -	TC -	S -	E -	OT -	O -

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s): José Carlos Rufino Amaro, Carlos Eduardo Castro Correia, Gilberto Sousa Ferraz

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. understand the role of each computing system component
2. recognize the importance of digital logic in the building of computing systems, and understand how numeric and text data are represented and handled
3. know the operating mechanism of a processor for the execution of programs, and understand the impact of some improvements on the original von Neumman model
4. identify and characterize the various storage levels, and the different IO techniques, of a computing system
5. understand the role and place of an operating system in the overall computing system
6. recognize the variety of operating systems and their different architectures
7. identify the types of services provided by the operating system and the basic mechanisms of protection and resource management
8. know how to install desktop-level operating systems in a virtualized environment and Windows Subsystem for Linux

Prerequisites

Before the course unit the learner is expected to be able to:
understand the operation and the goal of small programmes written in a high-level language

Course contents

Introduction to computer architecture. Data representation in computing systems. Boolean algebra and digital logic. Basic CPU operation. Storage and Input/Output technologies. Introduction to operating systems. Architecture of the operating system. Protection and management of resources. Virtualization.

Course contents (extended version)

1. Introduction to computer architecture
   - main components of a computer
   - historical evolution
   - the computer level hierarchy
   - the von Neumann model
2. Data representation in computing systems
   - positional numbering systems
   - signed integer representation
   - floating-point representation
   - characters representation
3. Boolean algebra and digital logic
   - boolean algebra
   - logic gates
   - digital components
   - karnaugh maps
4. Basic CPU operation
   - main CPU components
   - instruction set architecture
   - instruction assembly
   - instruction processing
   - addressing formats
   - addressing modes
   - instruction pipelining
5. Storage and I/O technologies
   - storage hierarchy
   - main memory
   - CPU cache
   - secondary storage
   - tertiary and quaternary storage
   - I/O subsystems
6. Introduction to operating systems
   - Operating system concept
   - Specialized systems and rnvironments
7. Architecture of the operating system
   - System services
   - User interfaces
   - System structure
8. Protection and management of resources
   - Hardware protection
   - Process management
   - Memory management
9. Virtualization
   - Basic concepts on virtualization
   - Installation of virtual machines
   - Installation of Linux Environments on Windows10/11 Machines using WSL2

Recommended reading

1. "The essentials of computer organization and architecture, 4th Ed. "; Linda Null, Julia Lobur; Jones and Bartlett Publishers; 2014
2. "Princípios Básicos de Arquitetura e Organização de Computadores, 2ª Edição"; Linda Null, Julia Lobur; Bookman; 2010
3. "Operating System Concepts, 10th Ed. "; Silberschatz, Galvin & Gagne; John Wiley & Sons; 2018
4. "Fundamentos de Sistemas Operacionais, 9a Ed. "; Silberschatz, Galvin & Gagne; LTC; 2015

Recommended reading

5. VMware Workstation Pro Documentation (https: //docs. vmware. com/en/VMware-Workstation-Pro/index. html)

Teaching and learning methods

The unit will be primarily taught using lectures that alternate the exposition of theoretical concepts with the resolution of exercises. All documentation (theoretical slides, exercises and solutions, practical assignments) will be provided through e-learning facilities.

Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final)
   - Intermediate Written Test - 28% (Part 1 - evaluation of item 1 to 3 of the course content)
   - Intermediate Written Test - 28% (Part 2 - evaluation of item 4 and 5 of the course content)
   - Final Written Exam - 39% (Part 3 - evaluation of item 6 to 9 of the course contents)
   - Experimental Work - 5% (Presence of classes)
2. Alternative 2 - (Regular, Student Worker) (Final, Supplementary)
   - Final Written Exam - 100% (Evaluates all parts (1+2+3). Modular exam (allows improving previous grades of any part).)
3. Alternative 3 - (Regular, Student Worker) (Special)
   - Final Written Exam - 100% (Evaluates all parts (1+2+3). Non-modular (does not consider previous grades of any part).)
4. Note: - (Regular, Student Worker) (Final, Supplementary)
   - Experimental Work - 5% (up to 1 value in the presence of classes.)

Language of instruction

Portuguese

Electronic validation

José Carlos Rufino Amaro	José Luís Padrão Exposto	Paulo Alexandre Vara Alves
15-10-2022	24-10-2022	24-10-2022