

Course Unit	Computer Networks		Field of study	Informatics	
Master in	Industrial Engineering - Electrical Engineering		School	School of Technology and Management	
Academic Year	2022/2023	Year of study	1	Level	2-1
Type	Semestral	Semester	2	ECTS credits	6.0
Code	9572-355-1204-00-22				
Workload (hours)	162	Contact hours	T 30	TP -	PL 30
			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) Luísa Maria Garcia Jorge, Eduardo Manuel Mendes Costa

### Learning outcomes and competences

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

1. Understand the importance of computer networks and how they operate and understand network devices operation and transmission media for computer networks.
2. Understand TCP/IP protocol layers, the IPv4 and IPv6 network protocols operation, addressing structure and routing.
3. Design and configure devices in small business networks: Configure switches, routers and inter-VLAN routing, including being able to troubleshoot and solve device configuration problems.
4. Understand and describe the operations of virtual private networks (VPNs) and security mechanisms.
5. Understand the basic concepts regarding emerging technologies including networks virtualization and software defined networking.

### Prerequisites

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

1. Present basic knowledge of operating systems.
2. Present basic knowledge of information technology.

### Course contents

Basic concepts of networks, protocols and layers. IPv4 and IPv6 addressing, switching, static and dynamic routing, physical networks and VLANs. Network design, wireless networking, DNS, DHCP and NAT. Wide area networks and network virtualization: Networks in practice, security and access control, network monitoring, network virtualization and software-defined networking. IoT and related protocols.

### Course contents (extended version)

1. Introduction to networks
  - LANs, WANs and internetworks
  - Networking concepts, infrastructure and security
  - Simple IP addressing examples and Cisco IOS basics
  - Network protocols and communication
  - Network access layer
  - Ethernet and switching
  - Network layer and routing
  - IP addressing and subnetting
  - Transport layer
  - Application layer services and protocols
2. Connections: Routing and switching
  - IPv4 and IPv6 addressing, including CIDR and VLSM
  - Static routing: Configuration of static routes; default and floating static routes
  - Dynamic routing: Protocols and configurations
  - Physical networks and Virtual Local Area Networks (VLANs)
  - Configuring VLANs and trunks; Inter VLAN routing
3. Business networks
  - LAN design and configuration: Characteristics of switched-structured LANs
  - Living with IPv4 limitations: Dynamic addressing using DHCPv4 and DHCPv6
  - Living with IPv4 limitations: Network Address Translation (NAT) operation and configuration
  - Wireless LANs, including configuration and security
4. Connecting the world: Wide area networks and network virtualization
  - Networking in practice: practical needs and solutions
  - Name-based addressing: DNS
  - Access control and security: VPNs and ACLs
  - Monitoring the network
  - New devices on the network: IoT and related protocols
  - The future: virtualization of networks and Software Defined Networking (SDN)

### Recommended reading

1. Monteiro, E. e Boavida, F. , "Engenharia de Redes Informáticas", 10ª Edição, FCA - Editora de Informática , 2011 [004. 73/MON/ENG]
2. Tanenbaum, Andrew S. e Wetherall, David J. , "Computer Networks", 5/E, Prentice Hall International, 2011 [004. 7/TAN/COM]
3. Cisco Networking Academy, CCNA v7 - Introduction to Networks; Switching, Routing, and Wireless Essentials; Enterprise Networking, Security, and Automation; Cisco Systems, 2019
4. Material de apoio produzido pelo docente, 2020

### Teaching and learning methods

The methods used will be expository and interrogative, the resolution of practical exercises (using real and simulated equipment), and individual or group study. The exercises to be solved, in the classroom and beyond, will be representative of real cases although simplified. The study material will be provided via the Cisco Academy e-learning system and the IPB e-learning system.

### Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final)
  - Intermediate Written Test - 40% (Theoretical intermediate assessments (two exams). Minimum grade: 35%.)
  - Practical Work - 60% (Practical and laboratory assignments.)

**Assessment methods**

2. Alternative 2 - (Regular, Student Worker) (Final, Supplementary, Special)
- Final Written Exam - 40% (Final theoretical exam (minimum grade: 35%))
  - Laboratory Work - 60% (Practical laboratory assignment.)

**Language of instruction**

Portuguese, with additional English support for foreign students.

**Electronic validation**

Lúisa Maria Garcia Jorge	José Luís Padrão Exposto	José Alexandre de Carvalho Gonçalves	José Carlos Rufino Amaro
05-03-2023	17-03-2023	17-03-2023	17-03-2023