COURSE SYLLABUS

Academic Year: 2024/2025

Identification and characteristics of the course				
Code	401087		ECTS Credits	6
Name (English)	NETWORK INTEGRATION			
Name (Spanish)	INTEGRACIÓN DE REDES			
Degree	Master Degree in Telecommunications Engineering			
Centre	School of Technology			
Semester	2	Carácter	Mandatory	
Module	2			
Subject	Telematics Networks and Services			

Lectures			
Name	Office	email	Web page
Rafael Martín Espada	2	rmmartin@unex.es	
Field od Studies	Telematic Engineering		
Department	Department of Computer Systems and Telematics Engineering		
Coordinator Lecture	Rafael Martín Espada		

Competencies

Basic Competences:

CB7: Students will learn how to apply acquired knowledge and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to this area of study

CB8: Students will be able to integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of their knowledge and judgments.

CB10: Students will have learning skills that allow them to continue studying in a way that will be mainly self-directed or autonomous.

General Competences:

CG2: Capacity for installations and project management related to telecommunication systems, complying with current regulations and ensuring a certain grade of quality of service.

CG4: Capacity for mathematical modeling, calculation and simulation in technological centers and business engineering, particularly in research, development and innovation tasks in all fields related to Telecommunication Engineering and related multidisciplinary fields.

CG6: Capacity for general management, technical direction and direction of research, development and innovation projects in companies and technology centers

CG10: Ability to apply the principles of economy and human resources management and projects, as well as legislation, regulation and standardization of telecommunications.

CG11: Ability to know how to communicate (orally and in writing way) conclusions - and knowledge and ultimate reasons that support them - to specialized and non-specialized audiences, in a clear and unambiguous way.

Specific competences:

CETT9: Ability to solve the convergence, interoperability and design of heterogeneous networks with local, access and trunk networks, as well as the integration of telephony, data, television and interactive services.
CETT13: Ability to design communication components such as routers, switches, hubs, transmitters and receivers in different bands.

Transversal Competences:
CT01: Innovative and entrepreneurial spirit.
CT04: Ability to communicate conclusions, acquired knowledge and ultimate reasons that sustain them to specialized and non-specialized audiences, orally and in writing way, in Spanish and English languages.
CT07: Capacity for critical reasoning and creativity, as means to have the opportunity to be original in the generation, development and / or application of ideas in a research or professional context.
CT10: Orientation to quality and continuous improvement.
CT11: Autonomous learning capacity.
CT12: Ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts.
CT13: Ability to integrate knowledge and face the complexity of making judgments based on incomplete information.

Learning outcomes of these competencies

- To master related concepts to new generation network technologies operation.
- To understands switching mechanisms operation in trunk networks
- To know the improvements brought about by switching for different types of services.
- To know the specification of requirements to offer quality of service.
- To be able to use tools for evaluating protocols and services performance.
- To know new trends in switching technologies development.

Contents and syllabus

Course Outline

Switches and routers architectures. LAN / MAN / WAN convergence technologies. Multicast. Integration protocols for new generation networks. MPLS / GMPLS. Optical Switching.

Course Contents

Lesson 1: Fundamentals

1. Networking concepts.
2. Multiplexing and switching.
3. Broadband and high performance.
4. LAN, WAN, MAN networks.

Lesson 2: Switching LAN

1. FastEthernet.
2. Gigabit Ethernet.
3. 10 GBE
4. LAN technologies:
    - 802.1Q
    - 802.1ad
    - 802.1p,
    - 802.1x
    - 802.11
    - Agregación de enlaces
    - STP
5. Switches networks applications: SAN, NAS, etc.
6. Configuring DHCP pools

7. DNS Server
8. WLAN con WLC environments
9. Installing and configuring Radius server
10. Firewall: Pfsense

Lesson 4: Wan Networks and trunking technologies

1. Routing
2. X.25.
3. RDSI-BE.
4. Frame Relay.
5. RDSI-BA. Packet Switching vs. Circuit Switching.
6. Switches architecture
7. Physical layer.
8. ATM Layer.
9. AAL Layer
10. IP over ATM
11. Multicast services with QoS warranties.

Lesson 4: MPLS Technology integration.

1. MPLS introduction.
2. LER switch architecture
3. LSR switch architecture
4. LAN/MAN/WAN convergence throughout label swicthing
5. Optical Switching. MP(lambda)S.
6. GMPLS.

Lesson 5: Software Defined Networks

1. SDN Introduction.
2. SDN diagram. Terms and technologies
3. Technical goals of SDN
4. SDN Roadmap

			Week Number															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Lesson	Te																	Test
	1	1		x														
	2	2			x	x	x											
	3	3						x	x	x	x	x						
	4	4											x	x	x			
	5	5														x	x	

Educational activities

Student hours of work per theme		Lectures	Practical sessions				Monitoring activity	Homework
Lesson	**Total**	**L**	**HI**	**LAB**	**COM**	**SEM**	**PT**	**PS**
1	8	2		1			0	5
2	54	16		8			0	30
3	42	12		3			0	27
4	20	6		1			0	13
5	22	6		1			0	15

Evaluation of the whole	4	3		1			0	0
Total	150	45		15			0	90

L: Lectures (100 students)
HI: Hospital internships (7 students)
LAB: Lab sessions or field practice (15 students)
COM: Computer room or language laboratory practice (30 students)
SEM: Problem-solving classes, seminars or case studies (40 students)
SGT: Scheduled group tutorials (educational monitoring, ECTS type tutorials)
PS: Personal study, individual or group work and reading of bibliography

Teaching Methodology

The methodology used in the lectures will be problem-based learning (PBL, Problem Based Learning), by proposing several problems related to the most common Network Integration area in the business world (LAN and WAN integration and functionalities), that will be related to possible tasks that students may perform in their next future jobs, within the limits of the subject contents.

Through teamworks, the needed knowledge will be acquired by solving these problems, enhancing those skills necessary to carry out collaborative work based on the opinions of the group members to which the student belongs.

The practical part of the course will consist of attending laboratory practices and making a regular delivery of activities carried out al classroom, at the laboratory or through personal work.

Learning outcomes

• Learn about the problems associated with the integration of local networks and WAN networks in business environments
• Learn about the new paradigms regarding network and system virtualization and its integration with corporate environments and platforms
• Knows the systems and methodologies for the implementation of management systems and business applications (DNS, RADIUS, DHCP, etc.), analyzing the organizational aspects related to it.
• Knows the fundamental elements of communication networks, the importance of their correct administration and the management of business environments
• Learn about network equipment, routers and switches and their manual configuration, as well as develop operational environment troubleshooting skills.

Evaluation systems

It will be evaluated:
- Knowledge of the theoretical concepts of the subject.
- The ability to solve problems and questions about the concepts developed.
- The realization of the simulation programs proposed in the laboratory.
- Active participation in debates in the classroom / laboratory.

Students´ activities carried out at Large Group must be assessed through a final exam that will represent 40% of the total score.

The correct performance of laboratory practices and class work throughout the course will represent 40% of the final score.

The different parts will add up with the aforementioned weighting, once each part has been passed independently.

Final score = 0.4 * Final exam + 0.6 * Laboratory practices

Alternatively, the student will be offered the possibility of demonstrating the subject competences acquisition through a written exam test that will represent 100% of the final score. The student who chooses this option will automatically discard the grades obtained both in the continuous assessment and in the work related to the activity in the Laboratory.

Bibliography (basic and complementary)

Virtual campus website.
- José M. Caballero, "Redes de banda Ancha.", Ed. Marcombo, 1.998.
- Jesús García Tomas et al, "Redes de alta velocidad", Ed. ra-ma, 1.997.
- F. Halsall, "Redes de Computadores e Internet." , 5ª Ed. Addison-Wesley, 2006.
- Rainer Händel, Manfred Huber and Stefan Schröeder, "ATM Networks: Concepts, protocols, applications", Ed Addison-Wesley, 1.995.
- Martin de Pricker, "Asynchronous Transfer mode. Solution for broadband ISDN.", Ed. Prentice Hall, 1.995.
- J.M. Pitts and J.A. Schormans, "Introduction to ATM Design and performance.", Ed. Wiley,1996
- Daniel Minoli, Thomas Golway and Norris Parker Smith, "Planning & Managing ATM networks.", Ed. Manning, 1.997.
- Normas ITU-T I.361, I.363, I.363.5, I.371.1, I.610. Norma ATM Forum af-tm-0056.000. - Andrew S. Tanenbaum, "Computer Networks (3rd edition)", Ed. Prentice Hall, 1.997. William Stallings, "Data and Computer Communication (5th edition)", Ed. Prentice Hall,1997 Stevens W. Richard, "TCP/IP Illustrated, Vol. 1: The protocols", Ed. Addison-Wesley,1994
- Fred Halsal, "Data communications. Computer Networks and Open Systems (4th edition)", Ed. Addison-Wesley, 1,996.
- Gilbert Held, "Ethernet Networks (2nd edition)", Ed. John Wiley & Sons, 1.996

Tutorial timetable

To be determined when the classes timetable is known. Nevertheless, it can be consulted via web.

Recommendations