Teaching Guide				
Identifying Data				2023/24
Subject (*)	Network Design		**Code**	614G01082
Study programme	Grao en Enxeñaría Informática			
Descriptors				
Cycle	**Period**	**Year**	**Type**	**Credits**
Graduate	1st four-month period	Fourth	Optional	6
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Enxeñaría de Computadores			
Coordinador	Gonzalez Lopez, Miguel		**E-mail**	miguel.gonzalez.lopez@udc.es
Lecturers	Gonzalez Lopez, Miguel		**E-mail**	miguel.gonzalez.lopez@udc.es
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Web	moodle.udc.es/course/view.php?id=44735			
General description	The goal of the subject is to introduce the most recent schemes in IP networks, Wireless Sensor Networks (WSNs) and Mobile Ad-hoc NETworks (MANETs). It covers topics like quality of service (QoS), IPv6, virtual private networks (VPNs), WSNs, MANETs, and their routing algorithms.			

Study programme competences / results	
Code	**Study programme competences / results**
A17	Coñecemento e aplicación das características, funcionalidades e estrutura dos sistemas distribuídos, as redes de computadores e internet, e deseñar e implementar aplicacións baseadas nelas.
A55	Capacidade para seleccionar, deseñar, despregar, integrar e xestionar redes e infraestruturas de comunicacións nunha organización.
B1	Capacidade de resolución de problemas
B3	Capacidade de análise e síntese
C3	Utilizar as ferramentas básicas das tecnoloxías da información e as comunicacións (TIC) necesarias para o exercicio da súa profesión e para a aprendizaxe ao longo da súa vida.
C6	Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.

Learning outcomes			
Learning outcomes	**Study programme competences / results**		
To know in depth the different elements with which a communications network can be built. Ability to analyze the advantages and disadvantages of each topology and network protocol. Knowing the algorithms that incorporate the protocols, and their applicability environments.	A17 A55	B1 B3	C3 C6

Contents	
Topic	**Sub-topic**
1. Quality of service (QoS)	1.1 QoS at layer 2.
	1.1.1 In wired networks (IEEE 802.1p).
	1.1.2 In wireless networks (IEEE 802.11e).
	1.2 QoS at layer 3.
	1.2.1 Integrated services (IntServ). RSVP protocol.
	1.2.2 Differentiated services (DiffServ). PHBs. Traffic classification, marking, metering (token bucket mechanisms), shaping, dropping. CBWFQ and LLQ queues. RED and WRED algorithms.
2. Analysis, design and addressing in IP networks. Advanced IP networks (IPv6)	2.1 IPv6: motivation, differences to IPv4, IPv6 extension headers, automatic address assignment, fragmentation, Neighbour Discovery (ND) protocol, multicast IPv6.

3. Virtual Private Networks (VPNs). IPsec.	3.1 VPNs: purpose, types, Level-2 VPNs (PPP) vs Level-3 VPNs (IPsec).
	3.2 IPsec: fundamentals, authentication (AH), Encapsulated Security Payload (ESP), key exchange mechanisms: IKE.
4. MANETs: Mobile Ad Hoc Networks	4.1 Motivation and fundamentals.
	4.2 Network layer. Routing algorithms: reactive, proactive and hybrid.
	4.3 Transport layer.
5. Wireless sensor networks (WSNs).	5.1 PHY/MAC layer. IEEE 802.15.4
	5.2 Network layer. RPL routing algorithm.
	5.3 Transport and application layer. CoAP and MQTT.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A17 A55 B1 B3 C6	21	51	72
Mixed objective/subjective test	A17 A55 B1 B3 C6	3	0	3
ICT practicals	B1 B3 C3	21	51	72
Personalized attention		3	0	3
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Guest lecture / keynote speech	Theory lectures, as well as illustrative examples and problems of the subject.
Mixed objective/subjective test	The content of the lectures will be evaluated through the final exam.
ICT practicals	Explanation and monitoring of ICT practices on the subject contents. The OMNET++ INET simulator and a network emulation tool based on virtualization will be used.

Personalized attention	
Methodologies	Description
Guest lecture / keynote speech ICT practicals	Question solving about the lectures and the ICT practicals.

Assessment			
Methodologies	Competencies / Results	Description	Qualification
ICT practicals	B1 B3 C3	It will be evaluated by means of the work reports on the practices carried out by the student. The due dates of the different work reports will be spaced throughout the term.	40
Mixed objective/subjective test	A17 A55 B1 B3 C6	The content of the guest lecture / keynote speech methodology will be evaluated through the final exam.	60

Assessment comments

Evaluation in the case of part-time students: the same as in the general case.

At the second opportunity, only one final exam will be taken for the guest lecture / keynote speech methodology. The practical grade will be that obtained during the course through the continuous evaluation of the student's work.

Copying and/or plagiarism: art. 14 section 4b of the UDC regulations will be applied: "Qualification of failure in the exam session in which the offence is committed and with respect to the subject in which it is committed: the student will be qualified with "failure" (numerical grade 0) in the corresponding exam session of the academic year, whether the offence is committed at the first opportunity or at the second opportunity. To this end, the grade will be modified in the first opportunity report, if necessary".

Sources of information	
Basic	- R. S. Koodli, C. E. Perkins (2007). Mobile Inter-networking with IPv6: Concepts, Principles and Practices. Wiley
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Infrastructure Management/614G01025
Network Administration/614G01048
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Communications Software/614G01034
Administration of Infrastructures and Information Systems/614G01216
Other comments