Universida_de_Vigo

IDENTIFYING DATA
Network Technologies

Subject	Network Technologies				
Code	V05M145V01104				
Study programme	Máster Universitario en Ingeniería de Telecomunicación				
Descriptors	ECTS Credits		Choose	Year	Quadmester
	5		Mandatory	1st	1st
Teaching language	Spanish Galician				
Department					
Coordinator	López Ardao, José Carlos				
Lecturers	López Ardao, José Carlos Suárez González, Andrés				
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General description	This subject covers the competencies in the BOE for the Master degree to achieve those professional attributions of Telecommunications Engineer related to the underlying technologies in the Computer Networks. In any way, it is an advanced course within the scope of these technologies, continuing and intensifying the basic contents studied in the subjects of the GETT.				

Training and Learning Results

Code	
A5	CB5 Students must have learning skills to allow themselves to continue studying in largely self-directed or autonomous way
B1	CG1 Ability to project, calculate and design products, processes and facilities in telecommunication engineering areas.
B4	CG4 Capacity for mathematical modeling, calculation and simulation in technological centers and engineering companies, particularly in research, development and innovation tasks in all areas related to Telecommunication Engineering and associated multidisciplinary fields.
B8	CG8 Ability to apply acquired knowledge and to solve problems in new or unfamiliar environments within broader and multidiscipline contexts, being able to integrate knowledge.
B12	CG12 Skills for lifelong, self-directed and autonomous learning.
C4	CE4 Ability to design and plan networks for transporting, broadcasting and distribution of multimedia signals.
C6	CE6 Ability to model, design, implement, manage, operate, and maintain networks, services and contents.
C7	CE7 Capacity for planning, decision making and packaging of networks, services and applications, taking into account the quality of service, direct and operating costs, plan implementation, monitoring, safety procedures, scaling and maintenance, as well as managing and ensuring quality in the development process.
C12	CE12 Ability to use programmable logic devices, as well as to design advanced electronic systems, both analog and digital. The ability to design communications components such as routers, switches, hubs, transmitters and receivers in different bands.

Expected results from this subject

Expected results from this subject	Training and Learning Results
Understand the fundamental results on the capacity for different types of networks	B1 B4 B8 C4 C6 C7

Understand, formulate and solve simple models for analyzing the performance of a computer network	B1
	B4
	B8
	C4
	C6
	C7
	C12
Know how to plan, design and deploy switched networks and IP networks in any application environment	A5
	B1
	B4
	B8
	B12
	C4
	C6
	C7
Know and understand the internal architecture of the switching equipment, methods of resource allocation and the basic techniques of providing Quality of Service	A5
	B1
	B4
	B8
	B12
	C4
	C6
	C12

Contents

Topic	
Topic 1: Switch Architecture	1.1. Data and control plane. Distributed and centralized control. 1.2. Software-defined networking (SDN). Fundamental characteristics. 1.3. Switch architecture. Types of switches
Topic 2: Queuing models for switches and communication networks	2.1. Specification and parameters of a queuing system. 2.2. Poisson Processes 2.3. Main queuing models 2.4. Queuing networks
Topic 3: Intradomain routing on the Internet: OSPF	3.1. Hierarchical routing on the Internet. Domains, ASs and ISPs 3.2. Protocols for intradomain routing. 3.3. OSPF 3.4. Types of OSPF Areas
Topic 4: Inter-AS Routing: BGP	4.1. BGP. 4.2. Attributes and path selection.
Topic 5. Route filtering	5.1. Route filtering. access lists and route-maps 5.2. BGP route filtering. 5.3. BGP Communities
Topic 6: Traffic engineering. MPLS-TE	6.1. Traffic engineering. 6.2. MPLS-TE
Topic 7: QoS architectures in ISPs	7.1. QoS Basic Concepts 7.2. Traffic classification and marking 7.3. Traffic Shaping and Policing 7.4. Buffer and bandwidth scheduling 7.5. DiffServ architecture
Topic 8: Network Virtualization	8.1. Network virtualization 8.2. L3 Provider Provisioned Virtual Private Networks (PPVPNs) 8.3. Ethernet VLANs. VLAN Trunking. 8.4. L2 tunnels 8.5. Ethernet VPNs
Topic 9: Data Center Networks	9.1. The network of a Data Center. 9.2. External and internal network virtualization. 9.3. 3-level hierarchical architecture. 9.4. Clos (Leaf & Spine) Architecture 9.5. EVPN in the Data Center 9.6. Alternatives to STP 9.7. Routing Issues in the Data Center

Planning

	Class hours	Hours outside the classroom	Total hours
Autonomous problem solving	0	21	21
Problem solving	3	6	9

Gamification	0	4	4
Lecturing	24	36	60
Laboratory practical	9	18	27
Objective questions exam	2	0	2
Essay questions exam	2	0	2

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Autonomous problem solving	Resolution of assignments, exercises, questions and self-assessment tests in the virtual classroom in a individual, autonomous way. These activities have a global weight of 15% in the case of continuous evaluation. With this methodology we will work the competences CB5, CG1, CG4, CG8, CG12, CE4, CE6, CE7, CE12
Problem solving	Resolution of problems of design, planning and dimensioning of networks. With this methodology we will work the competences CG1, CG4, CG8, CE6, CE7
Gamification	In the virtual classroom, we use a gamification system that employs activity points, mechanics and gamification elements to encourage the performance of online grading activities and to participate meaningfully in discussion forums. This will allow the student to obtain rewards to be used in the exams or in the continuous evaluation. The discussion forums will be the preferred way of answering questions related to the contents of the subject. The gamification will encourage peer support and collaborative resolution of doubts in the forums. Besides contributing to the increase of the motivation, with this methodology there will be worked also the competences CB5, CG12
Lecturing	Explaining of the ideas, concepts, technics and algorithms related to the thematic unities of the course. With this methodology we will work the competences CG1, CG4, CG8, CE4, CE6, CE7, CE12
Laboratory practical	Realization of practices for planning, design, configuration and resolution of problems of network scenarios. Software to be used: GNS3, WireShark. With this methodology we will work the competences CG1, CG4, CG8, CG12, CE4, CE6, CE7, CE12

Personalized assistance

Methodologies	Description
Lecturing	Individually personalized attention, face-to-face or by videoconference, will be dispensed. Students can ask for tutoring sessions following the instructions provided in the Moovi profile page of the teacher of this subject. https://moovi.uvigo.gal/user/profile.php?id=11640
Autonomous problem solving	In the case of tasks, the detailed solution will be provided in the virtual classroom. In the case of self-assesmemt tests, suitable feedback for the wrong questions will be provided to the student. In any case, individually personalized attention, face-to-face or by videoconference, will be dispensed. Students can ask for tutoring sessions following the instructions provided in the Moovi profile page of the teacher of this subject. https://moovi.uvigo.gal/user/profile.php?id=11640
Problem solving	Individually personalized attention, face-to-face or by videoconference, will be dispensed. Students can ask for tutoring sessions following the instructions provided in the Moovi profile page of the teacher of this subject. https://moovi.uvigo.gal/user/profile.php?id=11640
Gamification	In addition to individually personalized face-to-face attention, the professor will be monitor the discussions in the forums making suitable answers when necessary or explaining the answers of the students. The discussion forums are the way to request remote attention for doubts and questions related to the contents of the subject. Private attention about contents by means of messaging or e-mail is not available. In addition to individual attention during the tutorial schedule, the teacher will monitor the discussions in the forums, giving the appropriate response when necessary or explaining the student's answers if necessary. The forums in the virtual classroom are the preferred way of providing asynchronous attention to doubts related to the contents of the subject.
Laboratory practical	Individually personalized attention, face-to-face or by videoconference, will be dispensed.Students can ask for tutoring sessions following the instructions provided in the Moovi profile page of the teacher of this subject. https://moovi.uvigo.gal/user/profile.php?id=11640

Assessment

	Description	Qualification	Training and Learning Results		
Autonomous problem solving	During the course, with a roughly weekly periodicity, different tasks, activities, exercises, self-assessment tests must be made in the virtual classroom in an individual and autonomous way. These activities have a global weight of 20%	20	A5	B1 B4 B8 B12	C4 C6 C7 C12

Objective questions exam	Two intermediate one-hour multiple-choice tests will be carried out to check the progress of the subject. Each control test has a weight of 20%.	40	B1 B4 B8	C4 C6 C7 C12
Essay questions exam	Final exam covering the whole subject. It has a weight of 40% but a minimum score of 4 points out of 10 is required to pass the subject.	40	B1 B4 B8	C4 C6 C7 C12

Other comments on the Evaluation

The students can choose the Assesment method, continuous or global.

Continuous Assesment (CA)

It will consist of:

- Two intermediate one-hour multiple-choice tests (**C1 and C2**) will be carried out to check the progress of the subject. Each control test has a 20% weight in the Final Grade (**FG**). The schedule of the midterm/intermediate exams will be approved in the Comisión Académica de Máster (CAM) and will be available at the beginning of each academic semester

- The participation in the online activities in virtual environment, that represent 15% of the Final Grade (**FG**). During the course, with a roughly weekly periodicity, different tasks, activities, exercises, self-assessment tests will be proposed in the virtual classroom. These activities must be realized by all students in an autonomous, individual way. The realization of these activities allows students to obtain "merit points" (**MP**) up to a maximum of 200 points (in case of all activities are evaluated with the maximum grade). The grade of this section will be equal to the **amount of MP divided by 100**. In order to facilitate the achievement of the maximum amount of points, additional optional tasks will be proposed throughout the course.

- The virtual classroom includes a **gamification** system based in other types of points and several gamification elements and mechanisms to motivate students to make the activities and participate in a meaningful way in forums of doubts and discussions. This system allows students get **rewards** to be used in exams.

- A final exam (**FE**) covering all contents, with a weight of 40% of the Final Grade (**FG**). A minimum qualification of 4 points on 10 is required

FG-CA = 0.2x(C1 + C2) + MP/100 + 0,4xFE if FE >= 4

If FE < 4, the Final Mark will be equal to min{4.9, FG-CA} where FG-CA would be the final mark of the continuous assessment evaluation calculated before

It is considered that a student chooses CA when presenting to any midterm control test (C1 or C2). If any of these control tests are not made, the grade will be "0". These control tests will be not recoverable.

Gobal Assesment (GA)

It will only consist of the same FE at the end of the term.

Students who do not take any midterm exam, compulsorily opt for the Global Assesment.

Extraordinary call

A new final exam (FE) will be done in the official dates only for students not passing in the ordinary call.

Those students who have failed in the first call by going through Continuous Assesment and wish to renounce it in order to choose the Gobal Assessment, will have to request it in writing to the coordinator before the review date of the first final exam. In this case, any reward obtained by the CA activities carried out in the virtual classroom is also waived.

End-of-program exam

The same procedure as for the global assessment will be used for the end-of-program call.

Other comments

All students taking any final exam are considered to be presented to the subject. The grades for all exams, partial or final, and activities will affect only the actual academic year.

The virtual classroom platform has tools to detect possible anomalous and dishonest behaviors in self-assessment tests (tests carried out among several people, previously known answers, etc.), as well as to detect plagiarism in written works or in software programs.

Plagiarism is regarded as serious dishonest behavior. If any form of plagiarism is detected in any works/test/exams, including the activities on the virtual platform, the final grade will be FAIL (0), and the incident will be reported to the corresponding academic authorities for prosecution.

In case of any contradiction that may occur between the different versions of the guide, due to some error in the translation, the version that will prevail is the Galician language version.

Sources of information

Basic Bibliography

J.F. Kurose, K.W. Ross, **Computer networking: a top-down approach featuring the Internet**, 7ª,

Diane Teare, **Implementing Cisco IP Routing (ROUTE) Foundation Learning Guide**, Cisco Press,

P. Görason, C. Black, T. Culver, **Software Defined Networks: A comprehensive approach**, 2ª, Morgan Kauffman, 2017

Gary Lee, **Cloud Networking: Understanding Cloud-Based Data Center Networks**, Morgan Kaufmann, 2014

R. Chayapathi, S. Hassan, P. Shah, **Network Functions Virtualization (NFV) with a Touch of SDN**, Addison Wesley, 2016

Complementary Bibliography

Kun I. Park, **QoS in packet networks**, 1ª,

Richard Froom, Balaji Sivasubramanian, Erum Frahim, **Implementing Cisco IP Switched Networks (SWITCH) Foundation Learning Guide**, Cisco Press,

William Stallings, **Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud**, Addison Wesley, 2016

Jim Doherty, **SDN and NFV Simplified**, Pearson Education, 2016

Recommendations