Universida_{de}Vigo

Subject Guide 2016 / 2017

IDENTIFYI	NG DATA			
Computer	Networks			
Subject	Computer Networks			
Code	V05G300V01403			
Study	Degree in			
programme	Telecommunications			
	Technologies			
	Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	<u>2nd</u>
Teaching	Spanish			
language	Galician			
Departmen	t			
Coordinator	Rodríguez Pérez, Miguel			
Lecturers	López Ardao, José Carlos			
	Rodríguez Pérez, Miguel			
	Rodríguez Rubio, Raúl Fernando			
	Sousa Vieira, Estrella			
	Suárez González, Andrés			
E-mail	Miguel.Rodriguez@det.uvigo.es			
Web	http://www.socialwire.es			
General	Operating principles, architecture, technology and no	rms of computer ne	etworks, espec	ially of Internet. Design-
description	oriented course, complemented by practical skills			

Competencies

Code

- B1 CG1: The ability to write, develop and sign projects in the field of Telecommunication Engineering, according to the knowledge acquired as considered in section 5 of this Law, the conception and development or operation of networks, services and applications of Telecommunication and Electronics.
- B3 CG3: The knowledge of basic subjects and technologies that enables the student to learn new methods and technologies, as well as to give him great versatility to confront and adapt to new situations
- B4 CG4: The ability to solve problems with initiative, to make creative decisions and to communicate and transmit knowledge and skills, understanding the ethical and professional responsibility of the Technical Telecommunication Engineer activity.
- B6 CG6: The aptitude to manage mandatory specifications, procedures and laws.
- B9 CG9: The ability to work in multidisciplinary groups in a Multilanguage environment and to communicate, in writing and orally, knowledge, procedures, results and ideas related with Telecommunications and Electronics.
- C11 CE11/T6: The ability to conceive, deploy, organize and manage networks, systems, services and Telecommunication infrastructures in residential (home, city, digital communities), business and institutional environments, being responsible for launching of projects and continuous improvement like knowing their social and economical impact.
- C17 CE17/T12: The knowledge and usage of concepts of communication network architecture, protocols and interfaces.
- C18 CE18/T13: The ability to differentiate the concepts of access and transport networks, packet and circuit switched networks, mobile and fixed networks, as well as distributed newtwork application and systems, voice, data, video, audio, interactive and multimedia services.
- C19 CE19/T14: The knowledge of methods of networking and routing, as well as the fundamentals of planning and network evaluation based on traffic parameters.
- D2 CT2 Understanding Engineering within a framework of sustainable development.
- D3 CT3 Awareness of the need for long-life training and continuous quality improvement, showing a flexible, open and ethical attitude toward different opinions and situations, particularly on non-discrimination based on sex, race or religion, as well as respect for fundamental rights, accessibility, etc.
- D4 CT4 Encourage cooperative work, and skills like communication, organization, planning and acceptance of responsibility in a multilingual and multidisciplinary work environment, which promotes education for equality, peace and respect for fundamental rights.

Learning outcomes

Expected results from this subject		Training and Learning Results		
Comprise the general organization and the basic aspects of operation of communication networks, and particularly of computer networks	B3	C17	D2	
Identify and know employ the concepts of switching, access and transport networks and wired and wireless networks	B3	C18		
Comprise the principles and the organization of distributed applications and services, either data or media oriented	B3	C17		
Comprise and know how to analyze the operation of the Internet: the architecture, the service	B3	C11	D2	
model, the data transport, the routing methods and inter-networking, error control and congestion	B6	C17	D3	
control		C19		
Dominate the technical standards and the fundamental protocols of the Internet	B3	C17		
	Β4	C18		
	B6	C19		
Practical capacity to design, handle and configure computer networks, from the point of view of data switching and transport	B1 B9	C11	D4	

Contents	
Торіс	
1. Introduction	 a) Network Infrastructure: Nodes, links and netwoks
	b) Circuit and Packet Switching
	c) Communications Architecture: Layers, encapsulating, models
2. Packet Networks. Internet	a) Performance: Throughput, delays, losses
	b) The Internet ecosystem
3. Links and subnetworks	a) Concept of link and subnetwork
	b) Interconnection of networks at level 2: Bridges
4. Ethernet and WiFi	a) Ethernet Switching.
	b) VLANs and trunking
	c) Spanning Tree
	d) WiFi networks
5. Internet and IP	a) Interconnection of subnetworks. Routers
	b) IP Addressing
	c) IP datagram format
	d) Fragmentation
	e) The ICMP protocol
6. IP Forwarding	a) IP Forwarding mechanism
	 b) Connected and Next-Hop Routes
	c) The DHCP protocol
Name and address translation	a) ARP
	b) DNS
	c) NAT
8. Routing	a) Graph theory. Shortest distance paths
	b) Link state: Dijkstra's algorithm
	c) Distance vector: Bellman-Ford
	d) Broadcast routing
9. Internet routing	a) Routing hierarchy
	b) Intradomain routing: RIP, OSPF
	c) Interdomain routing: BGP
10. Transport protocols	a) Service model
	b) TCP & UDP
	c) Transport connections: establishment, retransmissions, flow control
11. Congestion control	a) Network model
	b) Dynamics, fairness and stability
	c) TCP Reno, Vegas, FAST
12. Network security	a) Vulnerabilities. Protection
	c) Secure network and transport layers
	c) Denial of service. Spoofing
	d) Fundamentals of cryptography
	e) Digital signatures

Planning					
	Class hours	Hours outside the classroom	Total hours		
Master Session	24	36	60		
Troubleshooting and / or exercises	10	15	25		
Autonomous practices through ICT	6	23	29		

Integrated methodologies	0	10	10	
Practice in computer rooms	10	10	20	
Long answer tests and development	1.5	0	1.5	
Long answer tests and development	1.5	0	1.5	
Long answer tests and development	3	0	3	
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*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
	Description
Master Session	Exposition of ideas, concepts, techniques and algorithms that shape every lecture. With this methodology students should acquire competencies CT2, CT3, CG3, CG4, CE11, CE17, CE18 & CE19.
Troubleshooting and / or exercises	Resolution by part of the students of problems and exercises of some of the lessons, and resolution by the teacher in the classroom. With this methodology students should acquire competencies CG3, CG4, CE11, CE17, CE18 & CE19.
Autonomous practices through ICT	The students must develop a network program. There will be several sessions for tutoring with the professor and development, test and debugging of the programs in the laboratories where these will be tested and evaluated. With this methodology students should acquire competencies CG1, CG6, CT4, CG9, CE11, CE17 & CE19.
Integrated methodologies	Participation in on-line activities to be proposed along the course, and in activities of making questions and answer of these. With this methodology students should acquire competencies CE17, CE18 & CE19.
Practice in computer rooms	Practices in the computers of the computer classroom, guided by the professor. With this methodology students should acquire competencies CG1, CG9, CE17 & CE19.

Personalized attention Methodologies Description Master Session Individual tuitition will be dispensed to the students in the office hours announced at the beginning of the term.

Assessment				
	Description	Qualification	Tra L	aining and earning Results
Autonomous practices through I	CT The students must develop a network program. There will be several sessions for tutoring with the professor and development, test and debugging of the programs in the laboratories where these will be tested and evaluated	20	B1 B6 B9	C17 C19
Integrated methodologies	Participation in on-line activities to be proposed along the course, and in activities of making questions and answer of these	10		C17 C18 C19
Long answer tests and development	Final exam	40	B3 B4	C11 C17 C18 C19
Long answer tests and development	Midterm exam	15	B3 B4	C11 C17 C18
Long answer tests and development	Midterm exam	15	B3 B4	C11 C17 C18 C19

Other comments on the Evaluation

The students can choose the method of evaluation, continuous or single.

The Continuous Evaluation (CE) consist of three previous tests plus a final exam:

- A midterm exam (ME) in the 5th week, which will cover the contents of lectures 1 to 4, and represents 15% of the final grade (FG)
- A midterm exam (ME) in the 9th week, which will cover the contents of lectures 5 to 8, and represents 15% of the final grade (FG)
- The development of a network program (NP). The deadline will be the last day of teaching in the lab. The compliance

of prescriptions and the quality of the software will determine the qualification of this test. Depending on the number of students, teachers may allow this program to be done by couples of students but in that case both members of the couple must belong to the same group of laboratory and both of them must follow continuous assessment. The NP represents 20% of the final (NF)

- Participation in online activities (AO) that will be proposed along the course and in the activities of raising questions and answer them. The OA represents 10% of the final grade (NG). The assessment procedure of these tasks will permit, in any case, obtaining the highest rating for any student. The maximum score in this section (10% of the subject) will be asigned to any student that successfully delivers the 8 massive delivery tasks to be proposed along the course. Also the highest score will be assigned to those students who score equal to twice the average or median, the least of them. The remaining students will obtain a mark proportional to the minimum among: the equivalent to the delivery of 8 tasks score, twice the median and twice the average.
- A final exam (FE) covering all the contents, which has a weight of 40% of the final grade (FG) and where it is necessary to obtain 3.5 points out of 10 to pass the subject.

FG-CE = 0.15·ME + 0.15·ME + 0.1·OA + 0.2·NP + 0.4·FE

The Single Evaluation (SE) will consist of the same Final Exam at the end of the semester and the same Network Program (NP) proposed for CE. In this case, the program must be made mandatory and delivered individually.

The grade of NP in this case is simply APT (with a numeric value 1), if it meets the minimum requirements or NOT APT (with a numeric value 0) in the other case or if the NP is not delivered, in which case the grade will be 40% of the FE. That is,

$FG-SE = (0.4 + 0.6 \cdot NP) \cdot FE$

It is considered that a student choose CE when presenting to any midterm exam. The students not doing this exam must opt for SE.

There will be a second evaluation with a new FE and it will also be allowed to deliver a new NP consisting of a modified version of the program of the first evaluation, and whose specifications will be published with at least 4 weeks with respect to the deadline of the Final Exam. Any students, regardless of having opted for CE or SE, will be able to do this FE and present a new NP. Those students that passed the subject in the first evaluation that want to attend the second one will have to present a signed letter asking the subject coordinator to assign them a "Not Presented" mark in the minutes of the first evaluation. The last day to present this letter is the day of the revision of the first evaluation exam.

For students who chose CE, these FE and NP represent an opportunity to improve the grade in these with respect to the fist evaluation, and so the calculation of the final grade considers the best grade obtained.

For students who chose to SE, the FE and the NP are considered joint and inseparable, that is,

$FG-SE = Max\{(0.4 + 0.6 \cdot NP-1st) \times FE-1st, (0.4 + 0.6 \cdot NP-2nd) \cdot FE-2nd\}$

All students that assists to any of the written tests will be considered for evaluation in this subject.

The grades of all written tests, partial or final, programs and activities will only take effect in the academic year in which they are proposed.

Sources of information

J.F. Kurose, K.W. Ross, **Computer networking: a top-down approach featuring the Internet**, 7, A. Leon-Garcia, I. Widjaja, **Communication networks: fundamental concepts and key architectures**, 2, L. Peterson, B. Davie, **Computer networks: a systems approach**, 5,

C. López, M. Rodríguez, S. Herrería, M. Fernández, Cuestiones de redes de datos: principios y protocolos, 1,

Recommendations

Subjects that continue the syllabus

Data Networks: Technology and Architecture/V05G300V01542 Multimedia Networks/V05G300V01643 Network Security/V05G300V01543 Internet Services/V05G300V01501 Network and Switching Theory/V05G300V01642

Subjects that are recommended to be taken simultaneously

Data Communication/V05G300V01301

Subjects that it is recommended to have taken before Mathematics: Calculus 1/V05G300V01105

Mathematics: Calculus 1/V05G300V01105 Mathematics: Probability and Statistics/V05G300V01204 Programming II/V05G300V01302

Other comments

Though advisable, it is not necessary prior exposure to computer programming.