Universida_{de}Vigo

Subject Guide 2023 / 2024

IDENTIFYIN	IG DATA				
Internet En	gineering				
Subject	Internet Engineering				
Code	V05M145V01210				
Study	Máster				
programme	Universitario en Ingeniería de Telecomunicación				
Descriptors	ECTS Credits		Choose	Year	Quadmester
	5		Optional	1st	2nd
Teaching language	Spanish				
Department					
Coordinator	Fernández Veiga, Manuel				
Lecturers	Fernández Veiga, Manuel				
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Web	http://moovi.uvigo.gal				
General description	Internet Engineering presents of large distributed systems in techniques, software defined n challenges of large data center Students will achieve skills for	and analises the state the Internet. The subj networking, multipath t rs. A review of network innovation and resear	of the art on the ect covers the stu ransmission, and and service virtu ch in the field of r	deployment, ope dy of advanced also the archite alization technic network enginee	erations and configuration channel coding cture and main technical ques is also included. ring.

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.

C8 CE8 Ability to understand and know how to apply the operation and organization of the Internet, new generation Internet technologies and protocols, component models, middleware and services.

Expected results from this subject	
Expected results from this subject	Training and
	Learning Results
Knowledge and know-how about advanced channel coding techniques	B4
	C4
	C6
To understand the operations and properties of large distributed systems in the In	ternet. Deep knowledge B1
and insights about advanced communication system	B4
	C4
	C6
	C7
	C8

To learn how to analyze and put into use multi path transmission techniques and congestion control					
algorithms on different types of networks	B4				
	B8				
	C4				
	C6				
	C7				
	C8				
	A5				
To understand the design principles, the operation and performance of large data centers in the Internet	B1				
	B4				
	B12				
	C6				
	C7				
	C8				
	A5				
To command the principles of network & services virtualization. To learn how to perform resource	B1				
allocation, to compare alternative architectures and comprehend the underlying Internet economic forces.	B4				
	B8				
	B12				
	C4				
	C6				
	C7				
	C8				

Contents		
Торіс		
1. Coding for distributed storage	1.1 Locally recoverable codes	
	1.2 Regenerating codes	
	1.3 Case studies	
2. Advanced channel coding	2.1 Capacity-approaching codes: LDPC, turbo	
	2.2 Capacity-achieving-codes: polar coding, SC-LDPC	
	2.3 Network coding	
3. Networking technologies for 5G	3.1 M2M, URLLC and NB-IoT communications	
	3.2 Architectures and models for 5G networks	
4. Resource allocation	4.1 Resource allocation in cloud systems	
	4.2 Load balancing techniques	
	4.3 Randomized policies. Optimal allocations	
	4.4 Auctioning	
5. MEC & edge computing	5.1 Architecture and services	
	5.2 Technology: NOMA, CRAN, SWIPT	
	5.3 Massive multiple access	
6. Coded caching	6.1 Centralized and distributed coded caching	
	6.2 Edge computing	
	6.3 Index coding	
7. Machine learning for networks	7.1 Machine learning & data-driven networks	
	7.2 Optimization- and model-based machine learning	
	7.3 Deep learning, reinforcement learning	
	7.4 Case studies in 5G/6G	

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	13	26	39
Laboratory practical	14	56	70
Laboratory practice	1	0	1
Essay questions exam	2	0	2
Problem and/or exercise solving	0	13	13
*The information in the planning table is fo	r guidance only and does no	ot take into account the het	erogeneity of the students.

Methodologies	
Description	

Lecturing	Descriptive exposure of concepts, technical problems and solutions of the state of the art in the discipline. Emphasis on the critical thinking ability to assess the models, the decisions and the operations of the systems under study.
	Through this methodology, the competencies CB5, CG1, CG4, CG8, CG12, CE4, CE6, CE7 and CE8 are acquired.
Laboratory practical	Development of an engineering project: design, planning, costs, dimensioning, configuration and testing, deployment and maintenance of a cloud-computing infrastructure.
	Through this methodology, the competencies CB5, CG1, CG4, CG8, CG12, CE4, CE6, CE7 and CE8 are acquired.

Personalized assistance					
Methodologies	Description				
Lecturing	Problem solving, advising about the material, recommended bibliography, further explanations of concepts and techniques. Individual mentoring about any of the latter matters. Office hours: [https://www.uvigo.gal/es/universidad/administracion-personal/pdi/manuel-fernandez-veiga]				
Laboratory practical	Help with the design, installation, configuration and use of any software piece needed for developing the practical project. Individual office hours. Office hours: [https://www.uvigo.gal/es/universidad/administracion-personal/pdi/manuel-fernandez-veiga]				

ASSESSINGIL			
Description Qualification	Tr	aining	g and
	Lear	rning	Results
Laboratory practice Functional and performance tests of the assigned engineering project. 30	A5	B1	C4
Critical assessment of the technical solutions, the design decisions and the		B4	C6
implementation.		B8	C7
	_	B12	C8
Essay questions Written examination, closed books, two hours length. The students will 40		B1	C4
exam answer questions of conceptual and logical character on any one of the		B4	C6
systems, components, algorithms or technologies that have been covered		B8	C7
in the lectures.		B12	C8
Problem and/or Written homework, selected problems and exercises. 30	A5	B4	C8
exercise solving	-	B8	

Other comments on the Evaluation

The student must choose between two alternative, mutually exclusive assessment method: continuous assessment or global assessment.

The continuous evaluation option consists in a final written exam (40% of the qualification), the completion of engineering assignments (30% of the qualification) and homework (30%). These assignments will be due the last working day preceding the start of the examination period. The eventual assessment option consists in a final written exam (60% of the qualification) and in the completion of assignments (40% of the qualification). The assignments will be due the last working day preceding the start of the examination period. The examinations of the continuous and the eventual assessment options may not be equal.

The students must declare their preferred assessment for global assessment right after the programming assignment is announced. A student cannot be considered as defective (not active) if continuous assessment is chosen.

The students who fail the course will be given an extraordinary opportunity at the end of the academic year to do so. Their academic achievements will be re-evaluated, both with a written exam (theoretical knowledge) and a review of their engineering project looking for improvement or changes. The weights are the same they were committed to, according to their choice.

Any assigned grade will only be valid during the academic year where it is awarded.

Sources of	information						
Basic Biblic	ography						
			-		-	-	

P. Goransson, C. Black, **Software defined networking: a comprehensive approach**, Morgan Kauffman, 2014 **Complementary Bibliography**

Y. Polyanskiy, Y. Wu, Information theory from coding to learning, Cambridge University Press, 2023

] I. Maric, S. Shamai, O. Simeone, Information Theoretic Perspectives on 5G and Beyond, Cambridge University Press,

2022] Özlem Tugfe Demir, Emil Björnson and Luca Sanguinetti, **Foundations of User-Centric Cell-Free Massive MIMO**, Foundations and Trends in Signal Processing, 2021

Songze Li and Salman Avestimehr, Coded Computing, Foundations and Trends in Communications, 2020

Recommendations

Subjects that it is recommended to have taken before

Network Technologies/V05M145V01104