

IDENTIFYING DATA				
Communication Advanced Systems				
Subject	Communication Advanced Systems			
Code	V05M145V01302			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	English			
Department				
Coordinator	Mosquera Nartallo, Carlos			
Lecturers	Gómez Cuba, Felipe Mosquera Nartallo, Carlos			
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Web				
General description	This course covers the application of advanced mathematical tools to address some challenges in new and emerging satellite and terrestrial communication systems, with special emphasis on lower layers and multiuser systems.			

Competencies	
Code	
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.
C22	CE22/PS2 Ability to understand the impact of the requirements of the telecommunications systems design services, with special emphasis in the lower layers, while maintaining a global vision of the solutions employed in modern commercial systems of communications.

Learning outcomes	
Expected results from this subject	Training and Learning Results
Understand the impact of telecommunication services requirements on system design, with special emphasis on lower layers.	B4 C22
Acquire a global view of the solutions developed for modern commercial communication systems.	B4 C22

Contents	
Topic	
1. Convex optimization	1.1 Basic concepts of convex sets 1.2 Introduction to convex functions 1.3 Quasiconvex functions 1.4 Convex optimization problems 1.5 Duality 1.6 Introduction to non-convex problems 1.7 Practical examples in communications
2. Multi-user fundamentals	2.1 Multi-user channels and bounds 2.2 Multiple-access channel: coordinated and uncoordinated access, rate regions, multiuser detection techniques, random access schemes. 2.3 Broadcast channel: rate regions, precoding, non-orthogonal techniques.

Planning

	Class hours	Hours outside the classroom	Total hours
Seminars	6	15	21
Problem solving	0	25	25
Lecturing	24	53	77
Problem and/or exercise solving	0	2	2

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

Methodologies

	Description
Seminars	Different communication systems will be presented with special emphasis on those challenges which are at the core of modern solutions and require advanced mathematical tools. Skills CG4 and CE22 are developed here.
Problem solving	Every week a homework challenge will be proposed to be solved with the aid of mathematical analysis, software tools or both. Skills CG4 and CE22 are developed here.
Lecturing	Advanced mathematical tools will be introduced as background material to address practical solutions in modern communication systems. Skills CG4 and CE22 are developed here.

Personalized assistance

Methodologies	Description
Lecturing	Student support will be provided during office hours and by e-mail.
Seminars	Student support will be provided during office hours and by e-mail.
Problem solving	Student support will be provided during office hours and by e-mail.

Assessment

	Description	Qualification	Training and Learning Results	
Problem solving	Every week a homework challenge will be proposed to be solved with the aid of mathematical analysis, software tools or both. If the solution is not turned in within the allocated deadline, the corresponding assignment will not be graded.	50	B4	C22
Problem and/or exercise solving	Final exam with short questions and exercises.	50	B4	C22

Other comments on the Evaluation

The students need to obtain 50 out of 100 points to pass the course. In addition, a minimum grade of 30% is required in the final exam; if this grade is not achieved, the final grade will be that obtained in the final exam. This applies also to the second call.

The grades obtained from the weekly assignments are only valid for the current academic year, and cannot be redone after the corresponding deadline. A student can decide to opt out the evaluation of the weekly assignments; in such a case, his/her final score will be fully based on the final exam. This applies also to the second call. Once the student turns in any of the deliverables, he/she will be considered to be following the continuous evaluation track.

Any student that chooses the continuous evaluation track will get a final score, regardless of her/his taking the final exam.

All the homeworks and exam will be given in English.

Sources of information

Basic Bibliography

Stephen Boyd, Lieven Vandenberghe, **Convex Optimization**, Cambridge University Press, 2004

Carlos Mosquera, **Class notes**, 2020

David Tse, Pramod Viswanath, **Fundamentals of Wireless Communication**, Cambridge University Press, 2005

Complementary Bibliography

Dimitri P. Bertsekas, **Convex Optimization Theory**, Athena Scientific, 2009

David G. Luenberger, Yinyu Ye, **Linear and Nonlinear Programming**, Fourth, Springer, 2016

Recommendations

Subjects that it is recommended to have taken before

Other comments

Attendance to physical classes is mandatory. If a minimum 80% attendance is not fulfilled, the grade will be entirely based on the final exam.

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

* Teaching methodologies are maintained, along with monitoring and assessment mechanisms.

* The interaction with the students will be performed on-line, with lectures and office hours offered in synchronous mode.