Teaching Guide			
Identifying Data			2019/20
Subject (*)	High Performance Infrastructures	Code	614473104
Study programme	Mestrado Universitario en Computación de Altas Prestacións / High Performance Computing (Mod. Presencial)		

Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	1st four-month period	First	Obligatory	6

Language	English		
Teaching method	Face-to-face		
Prerequisites			
Department	Enxeñaría de Computadores		
Coordinador	Rodriguez Osorio, Roberto	E-mail	roberto.osorio@udc.es
Lecturers	Rey Expósito, Roberto Rodriguez Osorio, Roberto	E-mail	roberto.rey.exposito@udc.es roberto.osorio@udc.es
Web	aula.cesga.es		
General description	The objective of this subject is to provide students with knowledge of the components of a current infrastructure for high performance computing, how they work together and how to manage them. The student will be able to design and manage high-performance infrastructures taking into account the analysis of the present needs and their possible future evolution, as well as the requirements to propose an infrastructure design project that will take into account hardware, software and support infrastructures. This will include the computational part, the storage of data, the communications infrastructure and the monitoring of the system.		

Study programme competences	
Code	Study programme competences
A2	CE2 - Analyze and improve the performance of a given architecture or software
A3	CE3 - Know the high performance computing basic concepts
A6	CE6 - Know the available tools for the distributed systems computing
B1	CB6 - Possess and understand the knowledge that give a baseline or opportunity to be original in the development and/or application of ideas, often in a research environment
B2	CB7 - The students have to know how to apply the acquired knowledge and their capacity to solve problems in new or hardly explored environment inside wider contexts (or multidiscipinary) related to its area of development
B4	CB9 - The students have to be able to communicate their conclusions, their knowledge and the reasons that hold them to specialized and non specialized audience in a clear and unambiguous manner
B5	CB10 - The students have to possess learning skills that allows them to continue to study in a mainly self-driven or autonomous manner
B6	CG1 - Be able to search and select useful information to solve complex problems, using the bibliographic sources of the field
B7	CG2 - Elaborate adqueately and originally written essays or motivated reasonings, write planings, work projects, scientific papers and formulate reasonable hypothesis
B8	CG3 - Be able to maintain and extend properly funded theoretical hypothesis to allow the introduction and exploitation of novel and advanced technologies in the field
B10	CG5 - Be able to work in teams, specially multidisciplinary, and do a proper time and people management and decision taking
B11	CG6 - Be able to understand and express in english, both written and spoken, information, ideas, knowledge, problems and solutions in the HPC environment
C1	CT1 - Use the basic technologies of the information and computing technology field required for the professional development and the long-life learning
C2	CT2 - Estimulate the capacity to work in transdisciplinary and interdisciplinary teams to offer proposals that contribute to the contribute to the economical, social and political sustainable development
C4	CT4 - Value the importance of research, innovation and the technological development in the socioeconomical and cultural advance of the society

Learning outcomes

Learning outcomes	Study programme competences		
Analyze and improve the performance of a given architecture or software	AJ2	BJ5 BJ6	CJ1
Know the concepts and basic techniques of high performance computing	AJ3	BJ1 BJ2 BJ4 BJ7 BJ11	CJ4
Know the technologies and tools available for computing in distributed systems over a network	AJ6	BJ8 BJ10	CJ2

Contents	
Topic	Sub-topic
Support infrastructure for high performance computing	Server technology Data center infrastructure Server virtualization
Storage technology	Storage devicces Storage networks Backup and data recovery
Design and administration of clusters for high performance computing	Introduction to computer clusters Deployment, configuration and administration of clusters Monitoring and optimization of clusters

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Laboratory practice	A2 B2 B10 C1 C2	20	50	70
Supervised projects	B5 B6 B7 B8 B11	0	57	57
Mixed objective/subjective test	B4 B6	2	0	2
Guest lecture / keynote speech	A3 A6 B1 C4	20	0	20
Personalized attention		1	0	1
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Laboratory practice	Problem solving and practical cases in the computer room, which allow the student to become familiar from a practical point of view with the issues exposed in the lectures.
Supervised projects	Assignments will be proposed consisting of gathering and analyzing information related to the lectures and the skill acquired during the labs.
Mixed objective/subjective test	Avaliation of acquired knowledge by means of a written or (if convenient) oral test
Guest lecture / keynote speech	Theoretical lectures, in which the content of each topic is exposed. The student will have copies of the slides beforehand, and the teacher will promote an active attitude, asking questions that allow clarifying specific aspects and leaving open questions for the reflection of the student.

Personalized attention	
Methodologies	Description

Laboratory practice Supervised projects	During the labs, a professor will assist the students by introducing the task, helping in the first stages, and solving doubts during the development of the tasks. Students may consult professors during the development of supervised projects.

Assessment			
Methodologies	Competencies	Description	Qualification
Laboratory practice	A2 B2 B10 C1 C2	The quality of the work developed inside and outside the lab will be valued.	50
Supervised projects	B5 B6 B7 B8 B11	The quality of the deliverables will be values, taking into account the degree of help that the student may have needed.	20
Mixed objective/subjective test	B4 B6	Written test or, only if needed, an oral test	30

Assessment comments
In order to pass the subject, it is required to achieve at least 50% of the total qualification Itis also required to obtain at least 50% of the maximum qualification in the written test. It is not possible to present the results of laboratory practices after the first written test. Students using the second opportunity will be evaluated according to the practices presented before the first test. However, it is possible for those students to present the supervised projects before the second opportunity. No special consideration is made with respect to part-time students. Those students that do not attend the written test, will be considered as "not presented"

Sources of information	
Basic	R. Rosen. Linux Kernel Networking. Implementation and Theory. 2014 Tom Shanley. InfiniBand Network Architecture. 2002 Matthew Portnoy. Virtualization Essentials, 2nd Edition. 2016 Kailash Jayaswal. Administering Data Centers: Servers, Storage, and Voice over IP. 2005 Ulf Troppens & Rainer Erkens & Wolfgang Müller. Storage Networks Explained: Basics and Application of Fibre Channel SAN, NAS, iSCSI, InfiniBand and FCoE. 2009 E. Nemeth & G. Zinder & T.R. Hein. Linux Administration Handbook. 2006Sam Alapati. Modern Linux Administration: How to Become a Cutting-Edge Linux Administrator. O'Reilly. 2016T. Sterling, M. Anderson, M. Brodowicz. High performance computing: modern systems and practices. Morgan Kaufmann. 2017
Complementary	Barb Goldworm & Anne Skamarock. Blade Servers and Virtualization: Transforming Enterprise Computing While Cutting Costs. 2007W. Curtis Preston. Backup & Recovery: Inexpensive Backup Solutions for Open Systems. 2007Tom Clark. Designing Storage Area Networks: A Practical Reference for Implementing Fibre Channel and IP SANs (2nd Edition). 2003Cougias & Heiberger & Koop. The Backup Book: Disaster Recovery from Desktop to Data Center 3rd Edition. 2003Barb Goldworm & Anne Skamarock. Blade Servers and Virtualization: Transforming Enterprise Computing While Cutting Costs. 2007W. Curtis Preston. Backup & Recovery: Inexpensive Backup Solutions for Open Systems. 2007Tom Clark. Designing Storage Area Networks: A Practical Reference for Implementing Fibre Channel and IP SANs (2nd Edition). 2003Cougias & Heiberger & Koop. The Backup Book: Disaster Recovery from Desktop to Data Center 3rd Edition. 2003

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
HPC on the Cloud/614473106

Subjects that continue the syllabus
Other comments

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.