# UNIVERSIDADE DA CORUÑA

| **Teaching Guide** | | | | |
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| **Identifying Data** | | | | **2019/20** |
| **Subject (*)** | High Performance Infrastructures | | **Code** | 614973104 |
| **Study programme** | Mestrado Universitario en Computación de Altas Prestacións / High Performance Computing (Mod. Virtual) | | | |
| **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** | Departamento profesorado másterEnxeñaría de Computadores | | | |
| **Coordinador** | Rodriguez Osorio, Roberto | | **E-mail** | roberto.osorio@udc.es |
| **Lecturers** | Rey Expósito, Roberto | | **E-mail** | roberto.rey.exposito@udc.es |
| | Rodriguez Osorio, Roberto | | | 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 / results** | |
|---|---|
| **Code** | **Study programme competences / results** |
| 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** |
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| Learning outcomes | Study programme competences / results | | |
|---|---|---|---|
| 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 / Results | Teaching hours (in-person & virtual) | Student?s personal work hours | Total hours |
| Laboratory practice | A2 B2 B10 C1 C2 | 0 | 70 | 70 |
| Document analysis | B5 B6 B7 B8 B11 | 0 | 22 | 22 |
| Supervised projects | A3 A6 B1 B4 C4 | 0 | 57 | 57 |
| 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. |
| Document analysis | Study of the notes, books and references on the internet that are available to the student |
| Supervised projects | Assignments will be proposed consisting of gathering and analyzing information related to the lectures and the skill acquired during the labs. |

| 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.<br><br>&amp;lt;br&amp;gt;<br><br>Students may consult professors during the development of supervised projects. |
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## Assessment

| Methodologies | Competencies / Results | 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 | A3 A6 B1 B4 C4 | The quality of the deliverables will be values, taking into account the degree of help that the student may have needed. | 50 |

## 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 each of the parts (labs and projects)

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, and the  supervised projects presented between the first and the second opportunities.

No special consideration is made with respect to part-time students.

## 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 &amp; Rainer Erkens &amp; Wolfgang Müller. Storage Networks Explained: Basics and Application of Fibre Channel SAN, NAS, iSCSI, InfiniBand and FCoE. 2009 E. Nemeth &amp; G. Zinder &amp; 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 &amp; Anne Skamarock. Blade Servers and Virtualization: Transforming Enterprise Computing While Cutting Costs. 2007W. Curtis Preston. Backup &amp; 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 &amp; Heiberger &amp; Koop. The Backup Book: Disaster Recovery from Desktop to Data Center 3rd Edition. 2003Ligazóns a páxinas de Internet que os profesores suministrarán no seu momento xa que poden cambiar con frecuencia. |

## 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