

## Course guide

### 270067 - CPD - Data Processing Centers

**Last modified:** 11/07/2025

**Unit in charge:** Barcelona School of Informatics  
**Teaching unit:** 701 - DAC - Department of Computer Architecture.

**Degree:** BACHELOR'S DEGREE IN INFORMATICS ENGINEERING (Syllabus 2010). (Optional subject).

**Academic year:** 2025    **ECTS Credits:** 6.0    **Languages:** Catalan

#### LECTURER

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**Coordinating lecturer:** DAVID LÓPEZ ÁLVAREZ

**Others:** Primer quadrimestre:  
JOSEP LLUÍS BERRAL GARCÍA - 11, 12  
DAVID LÓPEZ ÁLVAREZ - 11, 12

#### PRIOR SKILLS

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How to read English technical documentation, manuals and standards.

Basic knowledge of computer structure: Main elements of a computer, device input / output bus, direct memory access, interrupts.

Basic knowledge of operating systems: UNIX user-level, organization of an OS, drivers, processes, communication processes, data structures.

Basic knowledge of computer networks: structured in layers, TCP / IP, Ethernet, network programming (sockets), distributed applications

#### REQUIREMENTS

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- Pre-Corequisite SO
- Prerequisite XC

## DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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### Specific:

- CEC2.1. To analyse, evaluate, select and configure hardware platforms for the development and execution of computer applications and services.
- CEC2.2. To program taking into account the hardware architecture, using assembly language as well as high-level programming languages.
- CEC2.3. To develop and analyse software for systems based on microprocessors and its interfaces with users and other devices.
- CEC2.4. To design and implement system and communications software.
- CEC3.1. To analyse, evaluate and select the most adequate hardware and software platform to support embedded and real-time applications.
- CEC4.1. To design, deploy, administrate and manage computer networks.
- CEC4.2. To demonstrate comprehension, to apply and manage the guarantee and security of computer systems.
- CT3.5. To identify the use possibilities and benefits which can be derived from an application in the different business software typologies and existent ICT services.
- CT3.6. To demonstrate knowledge about the ethical dimension of the company: in general, the social and corporative responsibility and, concretely, the civil and professional responsibilities of the informatics engineer.
- CT6.2. To demonstrate knowledge, comprehension and capacity to evaluate the structure and architecture of computers, and the basic components that compound them.
- CT6.3. To demonstrate knowledge about the characteristics, functionalities and structure of the Operating Systems allowing an adequate use, management and design, as well as the implementation of applications based on its services.
- CT6.4. To demonstrate knowledge and capacity to apply the characteristics, functionalities and structure of the Distributed Systems and Computer and Internet Networks guaranteeing its use and management, as well as the design and implementation of application based on them.
- CT7.1. To demonstrate knowledge about metrics of quality and be able to use them.
- CT7.2. To evaluate hardware/software systems in function of a determined criteria of quality.
- CT7.3. To determine the factors that affect negatively the security and reliability of a hardware/software system, and minimize its effects.
- CT8.1. To identify current and emerging technologies and evaluate if they are applicable, to satisfy the users needs.
- CT8.4. To elaborate the list of technical conditions for a computers installation fulfilling all the current standards and normative.
- CTI1.1. To demonstrate understanding the environment of an organization and its needs in the field of the information and communication technologies.
- CTI1.2. To select, design, deploy, integrate and manage communication networks and infrastructures in a organization.
- CTI1.3. To select, deploy, integrate and manage information system which satisfy the organization needs with the identified cost and quality criteria.
- CTI1.4. To select, design, deploy, integrate, evaluate, build, manage, exploit and maintain the hardware, software and network technologies, according to the adequate cost and quality parameters.
- CTI2.1. To manage, plan and coordinate the management of the computers infrastructure: hardware, software, networks and communications.
- CTI2.2. To administrate and maintain applications, computer systems and computer networks (the knowledge and comprehension levels are described in the common technical competences).
- CTI2.3. To demonstrate comprehension, apply and manage the reliability and security of the computer systems (CEI C6).
- CTI3.1. To conceive systems, applications and services based on network technologies, taking into account Internet, web, electronic commerce, multimedia, interactive services and ubiquitous computation.
- CTI3.3. To design, establish and configure networks and services.
- CTI4. To use methodologies centred on the user and the organization to develop, evaluate and manage applications and systems based on the information technologies which ensure the accessibility, ergonomics and usability of the systems.

### Generical:

- G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.
- G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.

## TEACHING METHODOLOGY

Each week during the academic year there will be one class of theory and another one of laboratory 2 hours each.

The theory class is presented by the teacher, including theoretical concepts, practical examples and training exercises resolution.

The laboratory classes will be discussion and elaboration of scenarios. Classes will be highly participatory, in which students will have assigned tasks before class (studying some kind of software, architectural solution, ...), so it must provide what is learned during discussions / brainstorming explaining things in class when necessary. The laboratory classes will be held in classrooms with whiteboard and projector, as well as a computer student in order to make presentations, test software or search for information.

There are custom projects, in groups of up to 4 students (to be determined) that will develop a design of a data center with specific characteristics (constraints, objectives, resources available) for each different group. Part of the work will also do an audit of DPC designed by other groups.

All the work done by each student will join the portfolio of the student, which is a tool for evaluating the course.

In addition, depending on the availability of each course will be visits to DPCs real and / or lectures by experts.

## LEARNING OBJECTIVES OF THE SUBJECT

1. Structure of CPD: Identify the basic designing elements of a data processing center, its value and its importance in terms of application performance, reliability and center infrastructure costs.
2. Costs and efficiency of CPD: To understand and apply concepts of energy efficiency in the field of processed data centers, including aspects of energy consumption and maintenance costs of the facilities.
3. Data Center Management: To select the ICT management applications, computational resources, networking and storage technologies appropriate to achieve flexible and efficient administration of the CPD
4. Elements of Computing: To identify the needs of computer applications designed to run on large capacity data processing centers.
5. Applications: Design, architecture and deployment
6. Interconnection networks: To estimate the requirements of an application's network traffic to identify potential bottlenecks and to define the best strategy for deploying the application in the system
7. Storage systems: To identify the needs of distributed storage application designed to run on data processing centers of large capacity.
8. Security, Availability and Reliability: To identify security needs and availability of distributed applications designed to run on data processing centers of large capacity.
9. Information Unit and Unit Power: To evaluate the dependence of information and energy dependence.
10. Sustainability of the CPDS: To identify and evaluate the sustainability of the implementation chosen in their economic aspects, social and environmental
11. Communication skills: To participate in discussions and brainstorming to make CPD's designs and work plans, defending and arguing against a working team

## STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours large group	30,0	20.00
Hours small group	30,0	20.00

**Total learning time:** 150 h

## CONTENTS

### Introduction to the CPDS

#### Description:

This topic will present the main concepts related to CPDS, which will be studied in more detail on each topic later.

### Infrastructure of CPDS

**Description:**

This topic will deal with the structure of the CPDS and its main elements in terms of infrastructure. Will study the impact of aspects such as location, energy costs and cheaper to maintain them, its modularity and flexibility to manage them, and also present metrics for measuring efficiency .

### Storage Systems

**Description:**

This topic will discuss various architectures and tools for storing data. Students will learn how data storage systems work, and ideas of data security and recovery (backup, RAID) and different storage architectures (distributed, SAN/NAS)

### Networks

**Description:**

The objective of this topic is to cover the different aspects to consider when designing a data center network. Specifically, the main concepts acquired during the course in the field of networking are: design layered corporate networks (access, aggregation and core) and the concept of Network Fabric, interconnection technologies (Ethernet, FC, ☐☐ Infiniband, consolidation), network virtualization technologies and interconnected Data Centers.

### Computer Applications and features

**Description:**

The aim of this theme is present the main architecture of software and hardware used to run applications in the data center. From the standpoint of hardware architectures studied processors, memories and nodes used in such facilities. From the viewpoint of the software, explore the different paradigms used to develop applications specifically designed for use in CPDS, and therefore are massively parallel and distributed.

### Recaps

**Description:**

The aim of this last item is to review the concepts seen throughout the course in order to help the student to arrange the ideas seen throughout the semester, getting an overview of the subject.

## ACTIVITIES

### Development Unit 1: Introduction to the CPDS

**Description:**

Attending the class

**Specific objectives:**

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

**Related competencies :**

CTI4. To use methodologies centred on the user and the organization to develop, evaluate and manage applications and systems based on the information technologies which ensure the accessibility, ergonomics and usability of the systems.

G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.

G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

**Full-or-part-time:** 2h

Theory classes: 2h

### Development of theme 2: Infrastructure of CPDS

**Description:**

Attend classes. Study information about communication. Participate in the early debates / discussions. Prepare a presentation of the first two issues

**Specific objectives:**

1, 2, 3, 9, 10, 11

**Related competencies :**

CTI4. To use methodologies centred on the user and the organization to develop, evaluate and manage applications and systems based on the information technologies which ensure the accessibility, ergonomics and usability of the systems.

G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.

G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

**Full-or-part-time:** 8h

Self study: 2h

Theory classes: 2h

Laboratory classes: 4h

### Delivery kit of items 1-2

**Description:**

Work assigned on the first two issues

**Specific objectives:**

1, 2, 3, 9, 10, 11

**Related competencies :**

CTI4. To use methodologies centred on the user and the organization to develop, evaluate and manage applications and systems based on the information technologies which ensure the accessibility, ergonomics and usability of the systems.  
G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.  
G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

**Full-or-part-time:** 13h

Self study: 13h

### Development of item 3: Computer Applications and features

**Description:**

Attending classes prepare delivery of the subject application

**Specific objectives:**

3, 4, 5, 11

**Related competencies :**

CTI4. To use methodologies centred on the user and the organization to develop, evaluate and manage applications and systems based on the information technologies which ensure the accessibility, ergonomics and usability of the systems.  
G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.  
G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

**Full-or-part-time:** 15h

Self study: 3h

Theory classes: 6h

Laboratory classes: 6h

### Delivery kit of item 3

**Specific objectives:**

4, 9, 10, 11

**Related competencies :**

CTI4. To use methodologies centred on the user and the organization to develop, evaluate and manage applications and systems based on the information technologies which ensure the accessibility, ergonomics and usability of the systems.  
G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.  
G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

**Full-or-part-time:** 12h

Self study: 12h

#### Development of item 4: Networks

**Specific objectives:**

3, 6, 11

**Related competencies :**

CTI4. To use methodologies centred on the user and the organization to develop, evaluate and manage applications and systems based on the information technologies which ensure the accessibility, ergonomics and usability of the systems.

G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.

G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

**Full-or-part-time:** 15h

Self study: 3h

Theory classes: 6h

Laboratory classes: 6h

#### Delivery kit of item 4

**Specific objectives:**

4, 5, 9, 10, 11

**Related competencies :**

CTI4. To use methodologies centred on the user and the organization to develop, evaluate and manage applications and systems based on the information technologies which ensure the accessibility, ergonomics and usability of the systems.

G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.

G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

**Full-or-part-time:** 12h

Self study: 12h

#### Development of theme 5: Storage Systems

**Specific objectives:**

3, 7

**Related competencies :**

CTI4. To use methodologies centred on the user and the organization to develop, evaluate and manage applications and systems based on the information technologies which ensure the accessibility, ergonomics and usability of the systems.

G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.

G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

**Full-or-part-time:** 15h

Self study: 3h

Theory classes: 6h

Laboratory classes: 6h



#### Item 5 of delivery dossier

**Specific objectives:**

7, 9, 10, 11

**Related competencies :**

CTI4. To use methodologies centred on the user and the organization to develop, evaluate and manage applications and systems based on the information technologies which ensure the accessibility, ergonomics and usability of the systems.

G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.

G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

**Full-or-part-time:** 12h

Self study: 12h

#### Development Unit 6: Security, Availability and Reliability

**Specific objectives:**

3, 8

**Related competencies :**

CTI4. To use methodologies centred on the user and the organization to develop, evaluate and manage applications and systems based on the information technologies which ensure the accessibility, ergonomics and usability of the systems.

G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.

G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

**Full-or-part-time:** 15h

Self study: 3h

Theory classes: 6h

Laboratory classes: 6h

#### Delivery of item 6 pack

**Specific objectives:**

8, 9, 10, 11

**Related competencies :**

CTI4. To use methodologies centred on the user and the organization to develop, evaluate and manage applications and systems based on the information technologies which ensure the accessibility, ergonomics and usability of the systems.

G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.

G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

**Full-or-part-time:** 12h

Self study: 12h



#### Development of item 7: Wrap

##### Specific objectives:

1, 2, 3, 4, 5, 6, 7, 8, 9, 10

##### Related competencies :

CTI4. To use methodologies centred on the user and the organization to develop, evaluate and manage applications and systems based on the information technologies which ensure the accessibility, ergonomics and usability of the systems.

G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.

G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

##### Full-or-part-time: 4h

Theory classes: 2h

Laboratory classes: 2h

#### Visits to CPDS different entities and / or lectures by experts (depending on availability Four-Month)

##### Description:

Students must attend the tour / conference. Probably has to do some work (mainly reflecting on the visit / conference)

##### Specific objectives:

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

##### Related competencies :

CTI4. To use methodologies centred on the user and the organization to develop, evaluate and manage applications and systems based on the information technologies which ensure the accessibility, ergonomics and usability of the systems.

G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.

G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

#### Final delivery dossier

##### Specific objectives:

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

##### Related competencies :

CTI4. To use methodologies centred on the user and the organization to develop, evaluate and manage applications and systems based on the information technologies which ensure the accessibility, ergonomics and usability of the systems.

G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.

G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

##### Full-or-part-time: 15h

Self study: 15h



## GRADING SYSTEM

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The assessment will be based on the individual development of a portfolio by the student. This portfolio is based on deliveries made by students throughout the course of the corner. From each subject, each student will develop a number of activities. Students must achieve the objectives for each activity (objectives, not a mark).

Each issue will define a number of activities to be performed, and each activity will have a maximum score associate. There will be mandatory and optional activities and minimum requirements for some of them (for deemed obsolete).

The course has no final exam, and is based on a design project developed a CPD and a series of classroom activities, including oral presentations and discussions.

The mark for technical skills has a weight of 80% of the final grade. This leaves 60% of the project to develop and 40% of the various activities carried out in class.

The mark key skills has a weight of 20% of the final grade. These skills are integrated in the course, so it will be very difficult for each activity indicate what part of the note is associated with each key skill. If you clearly indicate which parts of the activities will influence the grade of technical skills and what to do to get the grade each student competition (regardless of influence on technical note), through rubrics.

## BIBLIOGRAPHY

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### Basic:

- Cisco Systems. Cisco data center infrastructure 2.5: design guide. Cisco Systems, Inc., 2011. ISBN 9781597493062.

### Complementary:

- Gai, S.; Desanti, C. I/O consolidation in the data center. Cisco, 2010. ISBN 1-58705-888-X.
- Gai, S.; Salli, T.; Andersson, R. Cisco unified computing system (UCS). Cisco, 2010. ISBN 1-58714-193-0.
- Alger, D. Grow a greener data center. Cisco Press, 2010. ISBN 1-58705-813-8.

## RESOURCES

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### Hyperlink:

- [http://www.cisco.com/en/US/netsol/ns743/networking\\_solutions\\_program\\_home.html](http://www.cisco.com/en/US/netsol/ns743/networking_solutions_program_home.html)- <http://www.slideshare.net/Ciscodatacenter>- <http://blog.ioshints.info>