

## Course guide

### 270126 - AD - Distributed Applications

**Last modified:** 13/07/2023

**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:** 2023    **ECTS Credits:** 6.0    **Languages:** Spanish

#### LECTURER

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**Coordinating lecturer:** SILVIA LLORENTE VIEJO

**Others:** Primer quadrimestre:  
SILVIA LLORENTE VIEJO - 11, 12

#### PRIOR SKILLS

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- Advanced knowledge in Java programming language.
- HTML knowledge is not required, but it will be used the whole course.
- How to read English technical documentation, manuals and standards.
- Basic knowledge of computer networks: protocols and transport network level, application-level functions, specially HTTP protocol.
- Basic knowledge of operating systems: user-level UNIX, Windows user-level, organization of an OS, drivers, processes, communication processes, data structures.

#### REQUIREMENTS

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- Prerequisite XC

#### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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##### Specific:

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.

CT7.2. To evaluate hardware/software systems in function of a determined criteria of quality.

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.

CTI1.4. 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.

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.

CTI3.2. To implement and manage ubiquitous systems (mobile computing systems).

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:

G1. ENTREPRENEURSHIP AND INNOVATION: to know and understand the organization of a company and the sciences which govern its activity; capacity to understand the labour rules and the relation between planning, industrial and business strategies, quality and benefit. To develop creativity, entrepreneur spirit and innovation tendency.

G8. APPROPRIATE ATTITUDE TOWARDS WORK: to have motivation to be professional and to face new challenges, have a width vision of the possibilities of the career in the field of informatics engineering. To feel motivated for the quality and the continuous improvement, and behave rigorously in the professional development. Capacity to adapt oneself to organizational or technological changes. Capacity to work in situations with information shortage and/or time and/or resources restrictions.

### TEACHING METHODOLOGY

The course consists of lectures and laboratory. In the lectures, the professor will introduce the concepts necessary to do the practice and raise issues and cases related to the subject. The student will have a collection of problems to be solved in class.

The laboratory is an important part of the course, as students will achieve the theoretical concepts from a more practical side of nature. Students will practice the statement before attending the laboratory. The statements will be posted on the website of the course. For each practice, there will be a short theoretical explanation and a dash of each practice. The lab sessions are scheduled to be made face after seeing the concepts in the lectures. If not, there will be a brief explanation to the laboratory for proper operation. Students must prepare in practice, reviewing the related theoretical concepts before the lab session.

### LEARNING OBJECTIVES OF THE SUBJECT

1. Being able to predict the performance of protocols and interpret the content of messages that use web applications.
2. Being able to interpret XML and JSON documents interchanged between web services.
3. Being able to configure an application server and launch a web application.
4. Being able to interpret the data interchanged between distributed applications.
5. Being able to configure an application server and implement web services.
6. Being able to configure an application server and implement web applications that make use of Web services.
7. Being able to describe existing formats of information and explain its normal use .
8. Being able to describe the client / server paradigm and give examples of protocols that follow it.
9. Be able to explain what a communications library is and give examples of existing libraries.
10. Be able to explain what an application server is and give examples of existing application servers.
11. Being able to describe at a high level specific characteristics of mobile applications.
12. Being able to develop a complete distributed application.
13. Being able to enumerate the differences between the different methods of transmitting multimedia content.
14. Being able to explain the results in practice "that make Web application development using Web services".
15. Being able to find information on a particular topic, apply it in the lab and write a report describing the results.
16. Ability to adapt to situations where there is lack of information and / or changes in the initial requirements.
17. Ability to answer questions related to the work done in the course of practices.
18. Gain awareness of how to work to get some good results.
19. Ability to list the different security mechanisms that can be applied to distributed applications.

### STUDY LOAD

Type	Hours	Percentage
Guided activities	6,0	4.00
Self study	84,0	56.00
Hours small group	30,0	20.00
Hours large group	30,0	20.00

**Total learning time:** 150 h

## CONTENTS

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### Introduction

**Description:**

Application level. Client-Server model. Remote invocation of operations /methods / procedures. Existing communications libraries. Information formats.

### Application and service development based on HTTP

**Description:**

Websites programming. Web Services. Application servers.  
Mobile networks features. Distributed mobile applications programming.

### Digital content representation and exchange

**Description:**

Formats: text, documents, image, video and metadata.

### Transmission and distribution systems of multimedia content

**Description:**

Streaming / download. Distribution Servers.

### Security in distributed applications

**Description:**

Security mechanisms at application level.

## ACTIVITIES

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### Developing topic: Introduction

**Description:**

Understanding of the content in order to apply them in the lab associated with the topic.

**Specific objectives:**

8, 9

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

Theory classes: 2h

Self study: 2h

#### Laboratory of the topic: Basic web application concepts

**Description:**

Understanding of web applications to be developed in the subject. Use of programming tools to check and modify its behaviour.

**Specific objectives:**

1

**Full-or-part-time:** 3h

Laboratory classes: 2h

Self study: 1h

#### Developing topic: Development of applications and services based on HTTP

**Description:**

Understanding the content in order to apply them in the lab associated with the topic.

**Specific objectives:**

2, 3, 4, 5, 6, 10, 11

**Related competencies :**

G1. ENTREPRENEURSHIP AND INNOVATION: to know and understand the organization of a company and the sciences which govern its activity; capacity to understand the labour rules and the relation between planning, industrial and business strategies, quality and benefit. To develop creativity, entrepreneur spirit and innovation tendency.

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

Theory classes: 6h

Self study: 7h

#### Laboratory of the theme: Developing Web applications

**Description:**

Understanding the configuration and operation of an application server to develop simple web applications.

**Specific objectives:**

3

**Full-or-part-time:** 11h

Laboratory classes: 6h

Self study: 5h

#### Developing topic: Representation and exchange of digital content

**Description:**

Understanding the content in order to apply them in the lab associated with the topic.

**Specific objectives:**

2, 7

**Full-or-part-time:** 11h

Theory classes: 6h

Guided activities: 1h

Self study: 4h

#### Lab topic: Developing Web Services

**Description:**

Understanding the configuration and operation of an application server to develop web services.

**Specific objectives:**

5

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

Laboratory classes: 6h

Self study: 9h

#### Developing topic: Transmission and distribution of multimedia content systems

**Description:**

Understanding the content in order to apply them in the lab associated with the topic.

**Specific objectives:**

13

**Full-or-part-time:** 10h

Theory classes: 5h

Self study: 5h

#### Lab topic: Developing web applications that make use of Web services

**Description:**

Understanding the configuration and operation of an application server to develop web applications that make use of Web services.

**Specific objectives:**

5, 6

**Related competencies :**

G1. ENTREPRENEURSHIP AND INNOVATION: to know and understand the organization of a company and the sciences which govern its activity; capacity to understand the labour rules and the relation between planning, industrial and business strategies, quality and benefit. To develop creativity, entrepreneur spirit and innovation tendency.

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

Laboratory classes: 6h

Self study: 6h

### First Theory control

**Description:**

Control of 2 hours long. Evaluated the content of topics 1. Introduction 2. Development of applications and services based on HTTP, 3. Representation and exchange of contents.

**Specific objectives:**

1, 4, 7, 8, 9, 10, 11, 16, 18

**Related competencies :**

G8. APPROPRIATE ATTITUDE TOWARDS WORK: to have motivation to be professional and to face new challenges, have a width vision of the possibilities of the career in the field of informatics engineering. To feel motivated for the quality and the continuous improvement, and behave rigorously in the professional development. Capacity to adapt oneself to organizational or technological changes. Capacity to work in situations with information shortage and/or time and/or resources restrictions.

**Full-or-part-time:** 9h 30m

Guided activities: 1h 30m

Self study: 8h

### Lab interviews (In the lab)

**Description:**

Explanation of work done in practice "Developing web applications that make use of Web services"

**Specific objectives:**

14

**Related competencies :**

G1. ENTREPRENEURSHIP AND INNOVATION: to know and understand the organization of a company and the sciences which govern its activity; capacity to understand the labour rules and the relation between planning, industrial and business strategies, quality and benefit. To develop creativity, entrepreneur spirit and innovation tendency.

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.

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

Laboratory classes: 4h

#### Lab interview

**Description:**

Interviews to evaluate the lab sessions "Desarrollo web applications that use Web services"

**Specific objectives:**

6, 12, 14, 17

**Related competencies :**

G1. ENTREPRENEURSHIP AND INNOVATION: to know and understand the organization of a company and the sciences which govern its activity; capacity to understand the labour rules and the relation between planning, industrial and business strategies, quality and benefit. To develop creativity, entrepreneur spirit and innovation tendency.

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**Full-or-part-time:** 5h

Guided activities: 3h

Self study: 2h

#### Subject explanation: Security in distributed applications

**Description:**

Understanding of the different security mechanisms that can be used at application level, such as digital signature, encryption, symmetric and asymmetric keys, privacy or authentication

**Specific objectives:**

1, 2, 4, 19

**Full-or-part-time:** 9h

Theory classes: 3h

Self study: 6h

#### Lab topic: Exploratory Practice

**Description:**

Understanding the information found on the chosen topic and write a report describing the results.

**Specific objectives:**

15, 16, 18

**Related competencies :**

G1. ENTREPRENEURSHIP AND INNOVATION: to know and understand the organization of a company and the sciences which govern its activity; capacity to understand the labour rules and the relation between planning, industrial and business strategies, quality and benefit. To develop creativity, entrepreneur spirit and innovation tendency.

G8. APPROPRIATE ATTITUDE TOWARDS WORK: to have motivation to be professional and to face new challenges, have a width vision of the possibilities of the career in the field of informatics engineering. To feel motivated for the quality and the continuous improvement, and behave rigorously in the professional development. Capacity to adapt oneself to organizational or technological changes. Capacity to work in situations with information shortage and/or time and/or resources restrictions.

**Full-or-part-time:** 16h

Laboratory classes: 6h

Guided activities: 2h

Self study: 8h

### Overview sessions

**Description:**

Posing questions about the matter to the teacher concerned. Preparation of control and the final exam

**Full-or-part-time:** 6h

Theory classes: 2h

Self study: 4h

### Second Theory control

**Description:**

Control of 2 hours duration. Evaluates the contents from part of topic 3. Digital content representation and exchange and topics 4. Transmission systems and distribution of multimedia content and 5. Security in distributed applications

**Specific objectives:**

1, 2, 7, 10, 13, 19

**Full-or-part-time:** 9h 30m

Guided activities: 1h 30m

Self study: 8h

### Final exam for the course

**Specific objectives:**

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 17, 19

**Related competencies :**

G1. ENTREPRENEURSHIP AND INNOVATION: to know and understand the organization of a company and the sciences which govern its activity; capacity to understand the labour rules and the relation between planning, industrial and business strategies, quality and benefit. To develop creativity, entrepreneur spirit and innovation tendency.

G8. APPROPRIATE ATTITUDE TOWARDS WORK: to have motivation to be professional and to face new challenges, have a width vision of the possibilities of the career in the field of informatics engineering. To feel motivated for the quality and the continuous improvement, and behave rigorously in the professional development. Capacity to adapt oneself to organizational or technological changes. Capacity to work in situations with information shortage and/or time and/or resources restrictions.

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.

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

Guided activities: 3h

Self study: 9h



## GRADING SYSTEM

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The evaluation of the course will have two parts: Theory (60%) and laboratory (40%).

The laboratory grade will be calculated from the mark achieved in practices and laboratory interviews.

The theory grade will be calculated from controls grade and/or the final exam, which is divided into two parts, as controls.

The formula for calculating the grade for the course will be:

$$NF = \text{MAX}(0.3*EF1, 0.3*C1) + \text{MAX}(0.3*EF2, 0.3*C2) + 0.4 * NL$$

Where:

NF = Note the end of the course.

EF1 = Final Theory exam, first part, same subjects as C1.

EF2 = Final Theory exam, second part, same subjects as C2.

C1 = First Theory Control.

C2 = Second Theory Control.

NL = Laboratory. Will be calculated based on the average of the practices delivery (50%) and the practices reports and interviews (50%). There are correction rubrics for practices.

Competence evaluation:

Technical competences are evaluated in the laboratory and their value corresponds to the 40% of the total mark of the subject. Moreover, the generic competence marks will be extracted from some laboratory activities, as described next.

The generic competence Emprenedoria i Innovació will be evaluated in the exploratory practice.

The generic competence Actitud Adequada Davant el Treball will be evaluated at the practice interviews.

Generic competences evaluation: They can have values A, B, C or D (where A corresponds to an excellent standard, B corresponds to a desired level, C corresponds to a sufficient level and D corresponds to a level not achieved). In case the corresponding activities are not done, the grade will be N/A (not applicable).

## BIBLIOGRAPHY

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### Basic:

- Kurose, J.F.; Ross, K.W. Computer networking: a top-down approach. 8th ed., global ed. Harlow, United Kingdom: Pearson Education Limited, 2022. ISBN 9781292405469.
- Tanenbaum, A.S.; Feamster, N.; Wetherall, D.J. Computer networks [on line]. Sixth edition. Harlow: Pearson, 2021 [Consultation: 14/07/2023]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pg-origsite=primo&docID=6432022>. ISBN 9781292374062.
- Cerami, E. Web services essentials. O'Reilly Media, 2002. ISBN 0596002246.

### Complementary:

- Golding, P. Next generation wireless applications: creating mobile applications in a web 2.0 and mobile 2.0 world. 2nd ed. John Wiley & Sons, 2008. ISBN 9780470725061.
- Niederst Robbins, J. Web design in a nutshell: [a desktop quick reference]. 3th ed. O'Reilly, 2006. ISBN 9780596009878.
- Tidwell, J. Designing interfaces: patterns for effective interaction design [on line]. 3rd ed. Sebastopol, CA: O'Reilly Media, Inc., 2020 [Consultation: 20/07/2023]. Available on: <https://ebookcentral-proquest-com/lib/upcatalunya-ebooks/detail.action?docID=5996435>. ISBN 9781492051916.
- Shklar, L.; Rosen, R. Web application architecture: principles, protocols, and practices. 2nd ed. John Wiley, 2009. ISBN 9780470518601.
- Jayasinghe, D.; Azeez, A. Apache Axis2 web services : create secure, reliable, and easy-to-use web services using Apache Axis2. 2a ed. Packt Publishing, 2011. ISBN 9781849511568.



## RESOURCES

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**Hyperlink:**

- <http://axis.apache.org/axis2/java/core/>-  
<https://www.w3.org/standards/webofdevices/>

<http://www.w3.org/standards/webofservices/>-