



Universidad  
de Alcalá

# TEACHING GUIDE

## Computer Networks (Redes de Computadores)

**Bachelor's Degree in  
Computer Science  
Computer Engineering**

**University of Alcalá**

**Academic Year 2019/2020**

**2<sup>nd</sup> Year – 2<sup>nd</sup> Term**

## TEACHIN GUIDE

Course name	<b>Computer Networks</b>
Code:	<b>780017</b>
Degrees:	<b>Computer Science Computer Engineering</b>
Department and Knowledge Area:	<b>Computer Engineering Department. Computer Architecture and Technology Area</b>
Type:	<b>Obligatory</b>
ECTS Credits:	<b>6</b>
Year and Term:	<b>2nd Year – 2nd Term</b>
Teaching Staff:	Agustín Martínez Hellín
Office hours:	<b>Check the course webpage</b>
Language:	Spanish/English

## 1. INTRODUCTION

This course, together with “Network Architectures” comprises the mandatory subject of “Telematics Fundamentals”. The subject contents encompass an introduction to telematics, the main elements of communication networks and the necessary knowledge to understand how they work, to analyse their performance, to design data networks and to make decisions about their deployment.

The learning process follows a top-down model, starting with the applications the students are already familiar with, discussing the needs these applications must work properly in a distributed environment. In this way, we go down the different layers of the protocol stack until we reach the link and physical layers.

This course continues the study started in “Network Architectures” (basic concepts and the application and transport layers), and finishes the top-down review of the classical protocol stack covering the network and link layers. Later, the course addresses the study of other technologies, not tied to a protocol layer, such as wireless and mobile networks, network security and network management.

In summary, the main content blocks we cover in this course are:

- Network interconnection. Addressing. Routing algorithms and protocols.
- Data link. Error control.
- Medium Access techniques. Local area networks. Switched networks. VLAN.
- Wireless networks. Mobile networks.
- Network security.
- Network management.

The course contents include activities of network monitoring, using traffic and protocol analysers, and network emulators.

It is recommended to have passed the course “Network Architectures” before taking this course.

## 2. COMPETENCES

### General skills:

CG3 Ability to design, develop, evaluate and ensure the accessibility, ergonomics, usability and safety systems, services and applications, as well as the information they manage.

CG6 Ability to design and develop systems or centralized or distributed architectures integrating hardware, software and networks according to the knowledge acquired as provided in paragraph 5 of resolution BOE-A-2009-12977.

CG8 Knowledge of basic materials and technologies that enable learning and development of new methods and technologies, as well as to equip them with great versatility to adapt to new situations.

CG9 Ability to solve problems with initiative, decision making, autonomy and creativity. Ability to communicate and transmit knowledge and skills of the profession of Technical Engineer.

CG10 Knowledge to perform measurements, calculations, assessments, appraisals, surveys, studies, reports, scheduling and similar work computer, according to the knowledge acquired as provided in paragraph 5 of resolution BOE-A-2009 -12,977.

### Specific skills:

CI1 Ability to design, develop, select and evaluate applications and systems, ensuring their reliability, safety and quality in accordance with ethical principles and legislation and regulations.

CI5 Knowledge, management and maintenance systems, services and applications.

CI11 Knowledge and application of features, functionality and structure of Distributed Systems, Computer Networks and Internet design and implement applications based on them.

### Learning outcomes

Students successfully passing this course will be able to:

**RA1:** Identify and explain the protocols and data formats used at the network layer in the Internet and at the link layer in wired and wireless local area networks, along with the mechanisms used to interconnect networks.

**RA2:** Organize, leverage and manage IP network addressing.

**RA3:** Describe and apply the routing algorithms and techniques used in IP networks.

**RA4:** Identify and describe the different medium access control techniques and explain the fundamentals of switched local area networks and VLANs.

**RA5:** Identify problems and propose basic solutions regarding network security and network management.

**RA6:** Teamwork in a collaborative way for the resolution of problems and to communicate in an effective way their knowledge, procedures, results and ideas about it, both in writing and in oral form.

### 3. CONTENTS

Content blocks	Number of sessions, credits or hours
Network layer: virtual circuits networks and datagram networks, IP and ICMP protocols. Routing protocols: OSPF y BGP. Addressing, DHCP protocol and NAT.	20 hours (5 weeks)
Link layer: link control; ARP; medium access control techniques; Ethernet; switches; VLAN; PPP protocol; wireless networks (Wi-Fi and Bluetooth) and mobile networks.	20 hours (5 weeks)
Cryptography and network security. Network management.	12 hours (3 weeks)
Global review and integration exercises.	4 hours (1 weeks)

## 4. TEACHING-LEARNING METHODOLOGY. FORMATIVE ACTIVITIES

### 4.1. Credit distribution

Class hours:	Theory 28 hours + Lab 28 hours + 4 hours of assessment
Students work hours:	Class preparation, exercise preparation, autonomous learning, lab and quiz preparation, readings, final exam preparation: Total: 90 hours
Total hours:	150 hours

### 4.2. Methodological strategies, materials and resources

Theory sessions (large groups)	<ul style="list-style-type: none"> <li>• Concept presentations and/or reviews.</li> <li>• Presentations, interactive activities and other activities.</li> </ul>
Clases Prácticas (en grupos reducidos)	<ul style="list-style-type: none"> <li>• Practical concept presentation and/or review</li> <li>• Problem solving. Case studies.</li> <li>• Practical lab sessions to strengthen previously presented concepts as well as to familiarize the student with IT and hardware tools that are useful to support the study of the subject and future professional performance (protocols analysers, network simulators).</li> <li>• Presentations, interactive activities and other activities.</li> </ul>
Individual, group and online office hours	<ul style="list-style-type: none"> <li>• Solving student questions</li> <li>• Support to autonomous learning</li> </ul>
Autonomous student work	<ul style="list-style-type: none"> <li>• Reading assignments.</li> <li>• Activities: exercises, information look up, self-assessment work.</li> </ul>

## 5. ASSESSMENT: Procedures and assessment and grading criteria

Assessment will be preferably continuous and formative, so that it serves as feedback within the learning process.

### Assessment procedures

Students have two opportunities to pass the course: an ordinary call and an extraordinary call.

#### 1. Ordinary call

In the ordinary call, students will undertake a continuous assessment process. This process includes lab assignments, self-assessment quizzes and several exams.

In exceptional circumstances, adequately documented, a student might be assessed by a single final exam. The student should request this in written form to the Dean, during the first two weeks after his enrolment, specifying the circumstances preventing him to follow the continuous assessment procedure. In this case, the Dean will get back to the student in a maximum of 15 days. If the student does not receive an answer within this time frame, the request will be considered accepted.

#### 2. Extraordinary call

The extraordinary call will have a similar exam to the one used for the final exam assessment in the ordinary call.

### Assessment Criteria

The assessment criteria evaluate the degree of acquisition of the competences described in Section 2 of this guide. The following criteria are described:

**CE1:** The student has acquired the technical knowledge regarding the network layer and link layer standards used in the Internet and in wired/wireless local area networks, respectively, regarding data format, protocols and network interconnection.

**CE2:** The student can leverage, organize and manage IP addressing spaces for an arbitrary network topology.

**CE3:** The student can compute shortest paths given a network topology using Distance Vector and Dijkstra algorithms, and to configure routing tables accordingly using a minimum number of entries.

**CE4:** The student can identify and describe the main medium access control techniques, and to solve basic medium access control exercises.

**CE5:** The student shows knowledge of the fundamentals of wireless LANs, switched LANs and VLANs.

**CE6:** The student shows knowledge about the fundamentals of cryptography and network security techniques used to achieve confidentiality, authentication and integrity in communication networks.

**CE7:** The student can explain the general problems and solutions related to network management.

**CE8:** The student shows skill to operate network simulation tools and protocol analysers.

**CE9:** The student is able to collaborate for the resolution of problems.

**CE10:** The student is able to communicate effectively his/her knowledge, procedures, results and ideas in the context of the subject, both in writing and in oral form.

### Grading instruments

The following grading instruments will be applied to each of the assessment criteria:

1. **Lab assessment assignments (PL):** lab assignments with protocol analysers and network emulators.
2. **Self- assessment quizzes (E):** online quizzes.
3. **Intermediate Assessment Exam (PEI):** involving practical exercises and demonstration of knowledge about theoretical concepts.
4. **Final Assessment Exam (PEF):** involving practical exercises and demonstration of knowledge about theoretical concepts. It will be like the PEIs, but with an additional, twofold goal: to assess the ability to relate the previously learnt concepts and to review the learning of those concepts.

### Grading Criteria

Here we quantify the grading criteria for the course.

#### *Ordinary Call, Continuous Assessment*

In the ordinary call with continuous assessment, we have the following relationship between assessment instruments and criteria.

Competences	Learning Outcomes	Assessment Criteria	Assessment Instruments	Weight in final grade
CG3, CG6, CG8, CG9, CG10, CI1, CI5, CI11	RA1-6	CE1-3, CE5-6, CE8-10	PL, E	20%
CG3, CG6, CG8, CG9, CG10, CI1, CI5, CI11	RA1-6	CE1-10	E	15%
CG3, CG6, CG8, CG9, CG10, CI5, CI11	RA1-3, RA6	CE1-3, CE10	PEI1	30%
CG3, CG6, CG8, CG9, CG10, CI1, CI11	RA4-5, RA6	CE4-7, CE10	PEI2	35%

All quizzes, exams and assignments are additive (there are not eliminatory tests). Students which, while undertaking the continuous assessment procedure, do not take any of the PEI and PEF, will have a "Not presented" grade in the ordinary call.



*Ordinary Call, Final Assessment*

Competences	Learning Outcomes	Assessment Criteria	Assessment Instruments	Weight in final grade
CG3, CG6, CG8, CG9, CG10, CI1, CI5, CI11	RA1-6	CE1-10	PEF	100%

*Extraordinary Call*

Competences	Learning Outcomes	Assessment Criteria	Assessment Instruments	Weight in final grade
CG3, CG6, CG8, CG9, CG10, CI1, CI5, CI11	RA1-6	CE1-10	PEF	100%

In the Extraordinary Call, all students will carry out the **PEF** test that covers the theoretical and practical contents of the subject. In the case of students subject to continuous evaluation in the ordinary call, they will have the option of maintaining their **laboratory grade** with a **weight of 20%** on the total grade.

## 6. BIBLIOGRAPHY

### Basic bibliography

- Redes de Computadoras: un Enfoque Descendente (7ª Ed. traducida), (7th. Ed. "Computer networking: A top-down approach" )  
J. Kurose & K.W. Ross  
Pearson Educación, 2017.

### Complementary bibliography

- Comunicaciones y Redes de Computadores (7ª Ed. traducida)  
W. Stallings  
Prentice Hall, 2004.
- Redes de Computadoras (4ª Ed. traducida)  
A.S. Tanenbaum  
Prentice-Hall, 2003.
- Redes de Computadores e Internet (5ª Ed. traducida)  
F. Halsall  
Pearson Educación, 2006.