



Universitat de Lleida

# DEGREE CURRICULUM **COMMUNICATION NETWORKS**

Coordination: FERNÁNDEZ CAMÓN, CÈSAR

Academic year 2021-22

## Subject's general information

Subject name	COMMUNICATION NETWORKS			
Code	102015			
Semester	2nd Q(SEMESTER) CONTINUED EVALUATION			
Typology	Degree	Course	Character	Modality
	Bachelor's Degree in Computer Engineering	2	COMPULSORY	Attendance-based
	Double bachelor's degree: Degree in Computer Engineering and Degree in Business Administration and Management	3	COMPULSORY	Attendance-based
	Master's Degree in Informatics Engineering		COMPLEMENTARY TRAINING	Attendance-based
Course number of credits (ECTS)	9			
Type of activity, credits, and groups	Activity type	PRALAB		TEORIA
	Number of credits	3.6		5.4
	Number of groups	4		2
Coordination	FERNÁNDEZ CAMÓN, CÈSAR			
Department	COMPUTER SCIENCE AND INDUSTRIAL ENGINEERING			
Teaching load distribution between lectures and independent student work	9 ECTS = 25x6 = 225 hours. - 90 class and lab hours. - 135 students own autonomous work.			
Important information on data processing	Consult <a href="#">this link</a> for more information.			
Language	Catalan.			
Distribution of credits	Cèsar Fernández Camón 1.5 Enric Guitart Baraut 14.4 Carles Mateu Piñol 3.9			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
CALDERO VIDAL, DAVID	dcaldero@diei.udl.cat	9,3	
FERNÁNDEZ CAMÓN, CÈSAR	cesar.fernandez@udl.cat	1,5	
GUITART BARAUT, ENRIQUE	enrique.guitart@udl.cat	14,4	

## Subject's extra information

Office hours need to be appointed beforehand by e-mail to be sure we can attend you and that we are not attending other students.

To properly follow this course, previous skills on basic programming and operating systems are recommended.

## Learning objectives

- Knowledge of current standard mechanisms and institutions.
- Learning data link protocols basics, as well as their weaknesses and capacities.
- Designing a physical and data-link level solution for a given scenario.
- Learning current network level protocol basics.
- Understanding network level protocol weaknesses and limitations and their solutions.
- Designing and addressing and routing solution for a given and basic scenario.
- Knowledge and ability to optimize transport protocols.
- Studying current data encoding and compression mechanisms.
- Knowledge and understanding encapsulation and abstraction models between network levels.
- Knowledge and understanding physical level data transmission mechanisms.
- Designing transport level protocols.
- Understanding performance factors and congestion control procedures.
- Knowledge and understanding of application level protocols, particularly those with multimedia containers.

## Competences

### Degree-specific competences

- GII-CR11 - Knowledge and application of the characteristics, functionalities and structure of Distributed Systems, Computer and Internet Networks, and the design and deployment of applications based on them.

### Degree-transversal competences

- EPS12 - Be motivated by quality and continual improvement.

## Subject contents

**Theme 1** Standards and organizations.

**Theme 2** OSI and TCP/IP models.

**Theme 3** Physical level: Introduction to data transmission

**Theme 4** Data-link level:

4.1 Direct access networks: Ethernet (802.3), Wireless (802.11).

4.2 Transport networks: ATM, xDSI, xDSL, MPLS/VPLS.

4.3 Switching.

**Theme 5** Network level.

5.1 IP protocols: IPv4 i IPv6.

5.2 IP addressing: IPv4 i IPv6.

5.3 Basic routing: static and vector-distance.

5.4 Advanced routing: link-state.

**Theme 6** Transport level.

6.1 End-to-end protocols: TCP and UDP.

6.2 Another end-to-end protocols.

**Theme 7** Congestion control and resource management.

**Theme 8** Application level.

8.1 Application protocols.

8.2 Multimedia applications.

## Methodology

The course is structured following the layered model of OSI/ISO network abstraction, we study the different technologies and network protocols starting with the physical level, and progressively increasing the ISO/OSI level, and hence abstraction with respect to the physical transportation of data. Despite using the ISO theoretical model, the protocol suite studied is the constituent of the Internet, TCP/IP. For each level there is a collection of problems that allow students to validate they achieved required knowledge. Also in a series of laboratory sessions, students will consolidate this knowledge as well as gaining a more applied view of networks, as the laboratories will be done using real enterprise-level network equipment to implement realistic networks in realistic scenarios.

## Development plan

Week 1. Theme 1. Standards and organizations.

Week 2. Theme 2. OSI and TCP/IP models

Week 3. Theme 3. Physical level: Introduction to data transmission

Week 4. Theme 3. Physical level: Introduction to data transmission

Week 5. Theme 4. Data-link level

Week 6. Theme 4. Data-link level

Week 7. Theme 4. Data-link level

Week 8. Holidays

Week 9. Theme 5. Network level

Week 10. Partial Exams 1

Week 11. Theme 5. Network level

Week 12. Theme 5. Network level. / Theme 6. Transport level

Week 13. Theme 6. Transport level

Week 14. Theme 7. Congestion control and resource management

Week 15. Theme 7. Congestion control and resource management

Week 16. Theme 8. Application level

Week 17. Partial Exams 2

## Evaluation

Acr.	Evaluation Activities	Weight	Minimum score	Group	Compulsory	Recoverable
P1	Project 1	20%	No	No	No	NO
P2	Project 2	24%	No	5	No	NO
P3	Project 3	20%	No	No	No	NO
E1	Midterm 1	18%	No	No	No	NO
E2	Midterm 2	18%	No	No	No	NO
Final score = $0,18 \cdot E1 + 0,18 \cdot E2 + 0,20 \cdot P1 + 0,24 \cdot P2 + 0,20 \cdot P3$						

### Continuous assessment:

- Midterm 1 test: 18 % (projects included).
- Midterm 2 test: 18 % (projects included)).
- Project 1 (Sockets/Programming): 20 %
- Project 2 (Physical and data-link level): 24 % (Laboratory classes are mandatory with a maximum of 2 absences allowed)
- Project 3 (Network level and TCP/IP): 20 %

The course is passed with a qualification  $\geq 5$ .

There's **NO** recovery test.

Acr.	Evaluation Activity	Weight	Minimum grade	Group	Compulsory	Recoverable
EU	Unique Exam	100%	Yes	No	Yes	Yes

## Single test assessment:

- Recovery test: 100% of the mark.
- Recovery test: (recoverable up to 80% of the grade).

This includes all the topics of the course (theory, practice and laboratory) in a single test.

To follow this evaluation students must notify it beforehand.

In case of delivery of any item of continuous assessment (practice and/or test) we will consider that students follow continuous assessment.

The course is passed with a qualification  $\geq 5$ .

## Bibliography

Computer Networks. A System Approach (Fifth Edition). Larry Peterson and Bruce S. Davie. Morgan Kaufmann, 2011.

Computer Networks (5th Edition). Andrew S. Tanenbaum and David J. Wetherall. Pearson, 2010.

Computer Networking: A Top-Down Approach (5th Edition). James F. Kurose and Keith W. Ross. Addison-Wesley, 2010.

TCP/IP Illustrated, Volumes 1 & 2. W. Richard Stevens. Addison-Wesley.

Networking. Jeffrey S. Beasley. Pearson, 2008.