



## Course guides

### 230041 - IX - Network Infrastructure

Last modified: 29/04/2020

**Unit in charge:** Barcelona School of Telecommunications Engineering  
**Teaching unit:** 744 - ENTEL - Department of Network Engineering.

**Degree:** BACHELOR'S DEGREE IN NETWORK ENGINEERING (Syllabus 2010). (Compulsory subject).  
BACHELOR'S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010). (Optional subject).  
BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject).

**Academic year:** 2020    **ECTS Credits:** 6.0    **Languages:** Catalan

#### LECTURER

---

**Coordinating lecturer:** Hesselbach Serra, Xavier

**Others:** Hesselbach Serra, Xavier  
Casademont Serra, Jordi

#### PRIOR SKILLS

---

Protocols architectures.  
Switching strategies.  
Definitions and basic concepts in circuits and packets networks.  
MAC protocols. Deterministic and random, centralized and distributed.  
Protocols and services in Internet (basic level).  
Probability and stochastic processes.  
Propagation in copper and optical fiber.  
Digital signals modulation.

#### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

---

**Generical:**

10 ECI N3. They will have acquired knowledge related to experiments and laboratory instruments and will be competent in a laboratory environment in the ICC field. They will know how to use the instruments and tools of telecommunications and electronic engineering and how to interpret manuals and specifications. They will be able to evaluate the errors and limitations associated with simulation measures and results.

#### TEACHING METHODOLOGY

---

Application sessions  
Lectures  
Laboratory sessions  
Works in groups (not in classroom)  
Individual works (not in classroom)  
Short questions exams (control)  
Short questions exams (Test)  
Long questions exams (Final exam)  
Laboratory exercises

## LEARNING OBJECTIVES OF THE SUBJECT

The main goal of this subject is the introduction of the concepts and current technologies in networks infrastructures. The subject shows the physical layer in order to transmit information, services, the data and control planes and the classification of the networks in access, transport and broadcast.

The student will be able to identify and study the problems, the current existing solutions and the tendencies, in order to learn procedures to take decisions among available technologies.

Learning procedure outputs:

- Skills to build, exploit and manage networks, services, processes and applications in telecommunications, from the view of Internet services.
- Understand and use the concepts of quality of service in several scenarios.
- Utilize the tools to build, exploit and manage the Internet services, including web and multimedia information.
- Protocols and interfaces in the protocols architecture, including the knowledge to program them, test and optimize.
- Learn the technological challenges in transmission and switching in networking and services.
- Use of books and papers, including skills to write a report or technical work in english, including the capacity to participate in technical meetings.
- Individual use of the tools and software applications of the labs ranging from basic to advances concepts. Discover the procedures and limitations.

## STUDY LOAD

| Type              | Hours | Percentage |
|-------------------|-------|------------|
| Hours small group | 26,0  | 17.33      |
| Self study        | 85,0  | 56.67      |
| Hours large group | 39,0  | 26.00      |

**Total learning time:** 150 h

## CONTENTS

### Topic 1. Introduction.

**Description:**

Concepts review  
Definitions

**Related activities:**

Lab:  
Introduction and fundamental concepts.....(3 weeks)  
Types of devices and wires  
Devices configuration  
Topologies  
Parameters and metrics  
Evaluation tools

**Full-or-part-time:** 14h

Theory classes: 2h  
Laboratory classes: 6h  
Self study : 6h

## Topic 2. Access networks

### Description:

Local loop  
Features  
Local loop model  
Unbundled local loop  
Twisted pair access networks. xDSL  
Types and features  
Hybrid fiber coaxial HFC  
Optical fiber access networks. FTTx  
Networks of the power line. PLC

### Related activities:

Lab: Performance evaluation of networks infrastructures.....(4 weeks)  
Methodology  
Use cases measurements  
Exercise realized individually at the lab.

### Full-or-part-time: 31h

Theory classes: 10h  
Laboratory classes: 6h  
Self study : 15h

## Topic 3. Transport networks

### Description:

PDH y SDH networks  
Fundamental concepts in transport networks  
Requirements  
Traffic classification  
Control mechanisms  
Admission control and police control.  
Leaky Bucket and Token Bucket.  
Fairness in traffic management for the backbone.  
Examples: Virtual circuit networks: ATM and MPLS  
SDN networks  
Motivation  
SDN architecture. Control and data plane separation.  
Applications: Network configuration, virtualization.

### Full-or-part-time: 30h

Theory classes: 14h  
Self study : 16h



#### Topic 4. Local area networks

**Description:**

Ethernet:

Ethernet basics

Ethernet physical mediums

Ethernet Implementations

Switches and Spanning Tree Protocol

Flow Control

Auto-negotiation

VLAN

Link aggregation

Power over Ethernet

Wireless Local Area Networks (WLAN)

IEEE802.11 standard: 802.11a/b/g/n/ac

Physical layer

MAC layer and access schemes (PCF and DCF)

Quality of service: 802.11e

Power management

Fairness and performance analysis

**Related activities:**

Lab:

Ethernet network configuration and Wifi Access Point usage.....(3 weeks)

Connections and types of devices

Measures: Throughput, delay and others.

Ethernet network configuration and Wifi connected to the backbone.....(3 weeks)

The physical medium.

Configuration and connection of devices.

IPv6 configuration and QoS allocation concerning network topology.

Exercise realized individually at the lab.

**Full-or-part-time:** 50h

Theory classes: 13h

Laboratory classes: 10h

Self study : 27h

#### Evaluation

**Description:**

Activities to evaluate the contents of the subject.

**Related activities:**

Mid-semester evaluation

2 evaluation exercises at the laboratory

Exam

**Full-or-part-time:** 25h

Laboratory classes: 4h

Self study : 21h

## GRADING SYSTEM

---

Laboratory exams: 30%  
Laboratory exercises reports: 10%  
First exam: 25%  
Final exam: 35%

This subject evaluate the following generic competences:

- Third language (Medium level)
- Experimentality and instruments knowledge (medium level)

## EXAMINATION RULES.

---

Regulations concerning "reavaluació" from ETSETB: Only applies to "Final Exam".

## BIBLIOGRAPHY

---

### Basic:

- Perros, H.G. Connection-oriented networks: SONET/SDH, ATM, MPLS, and optical networks. Hoboken: John Wiley, 2005. ISBN 0470021632.
- Stallings, W. Comunicaciones y redes de computadores [on line]. 7a ed. Madrid: Pearson Educación, 2004 [Consultation: 15/05/2020]. Available on: [http://www.ingebook.com/ib/NPcd/IB\\_BooksVis?cod\\_primaria=1000187&codigo\\_libro=1245](http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=1245). ISBN 8420541109.
- Rauschmayer, D.J. ADSL/VDSL principles: a practical and precise study of asymmetric digital subscriber lines and very high speed digital subscriber lines. Indianapolis: Macmillan Technical Publishing, 1999. ISBN 1578700159.
- Ilyas, M; Mouftah, H.T. The handbook of optical communication networks [on line]. CRC Press, 2003 [Consultation: 03/07/2014]. Available on: <http://lib.myilibrary.com?id=9560>. ISBN 9780203489642.
- Perahia, E.; Stacey, R. Next generation wireless LANs : throughput, robustness, and reliability in 802.11n, 802ac [on line]. 2a ed. New York: Cambridge University Press, 2013 [Consultation: 01/04/2020]. Available on: <https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=1139677>. ISBN 9781107347793.

### Complementary:

- Held, G. Ethernet networks: design, implementation, operation, management. 4th ed. West Sussex: John Wiley & Sons, 2003. ISBN 0470844760.
- Olifer, N.; Olifer, V. Computer networks: principles, technologies and protocols for network design. Chichester: John Wiley, 2006. ISBN 9780470869826.
- Spurgeon, C.E. Ethernet: the definitive guide [on line]. 2nd ed. Sebastopol, CA: O'Reilly, 2014 [Consultation: 19/02/2019]. Available on: <https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=1651722>. ISBN 9781449361846.
- Chen, W.Y. DSL simulation techniques and standards: development for digital subscriber line systems. Indianapolis: Macmillan, 1998. ISBN 1578700175.