Course guide
230041 - IX - Network Infrastructure

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

Degree: BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject).

Academic year: 2022  ECTS Credits: 6.0  Languages: Catalan

LECTURER

Coordinating lecturer: Consultar aquí / See here: https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/responsables-assignatura

Others: Consultar aquí / See here: https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/professorat-assignat-idioma

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>39,0</td>
<td>26.00</td>
</tr>
<tr>
<td>Self study</td>
<td>85,0</td>
<td>56.67</td>
</tr>
<tr>
<td>Hours small group</td>
<td>26,0</td>
<td>17.33</td>
</tr>
</tbody>
</table>

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:

Complementary: