300021 - IX - Network Interconnection Techniques

Coordinating unit: 300 - EETAC - Castelldefels School of Telecommunications and Aerospace Engineering
Teaching unit: 744 - ENTEL - Department of Network Engineering
Academic year: 2019
Degree:
- BACHELOR'S DEGREE IN NETWORK ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
- BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
- BACHELOR'S DEGREE IN AEROSPACE SYSTEMS ENGINEERING/BACHELOR'S DEGREE IN NETWORK ENGINEERING (Syllabus 2015). (Teaching unit Compulsory)
- BACHELOR'S DEGREE IN AEROSPACE SYSTEMS ENGINEERING/BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2015). (Teaching unit Compulsory)
- BACHELOR'S DEGREE IN AEROSPACE SYSTEMS ENGINEERING/BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING - NETWORK ENGINEERING (AGRUPACIÓ DE SIMULTANEÏTAT) (Syllabus 2015). (Teaching unit Compulsory)

ECTS credits: 6
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: Definit a la infoweb de l'assignatura.
Others: Definit a la infoweb de l'assignatura.

Opening hours
Timetable: See Infoweb site for more information

Prior skills

Requirements
CALCULUS - Prerequisite
Fundamentals of Communications - Co-requisite
Fundamentals of Telematics - Prerequisite
Probability and Statistics - Co-requisite

Degree competences to which the subject contributes

Specific:
1. CE 17 TELECOM. Conocimiento y utilización de los conceptos de arquitectura de red, protocolos e interfaces de comunicaciones. (CIN/352/2009, BOE 20.2.2009.)
2. CE 19 TELECOM. Conocimiento de los métodos de interconexión y encaminamiento, así como los fundamentos de la planificación, dimensionado de redes en función de parámetros de tráfico. (CIN/352/2009, BOE 20.2.2009.)

General:
7. EFFICIENT USE OF EQUIPMENT AND INSTRUMENTS - Level 1: Using instruments, equipment and software from the laboratories of general or basic use. Realising experiments and proposed practices and analyzing obtained results.

Transversal:
3. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.
4. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.
5. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

6. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

8. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

**Teaching methodology**

X

**Learning objectives of the subject**

X

**Study load**

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 26h</th>
<th>17.33%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group: 13h</td>
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<tr>
<td></td>
<td>Hours small group: 13h</td>
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<tr>
<td></td>
<td>Guided activities: 14h</td>
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<tr>
<td></td>
<td>Self study: 84h</td>
<td>56.00%</td>
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</table>
# INTRODUCTION

**Learning time:** 5h  
Theory classes: 2h  
Practical classes: 1h  
Laboratory classes: 0h  
Guided activities: 0h  
Self study: 2h

**Description:**  
Telecommunication network architecture.  
Communication protocol and service primitive concepts.  
Interconnection devices classification.  
Physical, link or network layer device differentiations.  
Communication device addressing.  
Addressing in local area networks:  
- MAC addresses: local and universals addresses.  
- IP addresses: Broadcast domain at network layer and link layer.  
- Subnetting  
- Broadcast and collation domain  
- Half and full-duplex

# LOCAL AREA NETWORKS AND ETHERNET

**Learning time:** 55h  
Theory classes: 8h  
Practical classes: 8h  
Laboratory classes: 3h  
Guided activities: 6h  
Self study: 30h

**Description:**  
Introduction  
- Local Area Network (LAN) characteristics  
- LAN architecture: physical layer and link layer  
- Local Area Networks main standards  
Link Layer  
- Protocols (IEEE 802.2)  
- MAC frame format  
- MAC layer services  
Physical layer  
- Full duplex features  
- Fast and Gigabit Ethernet
**WIRELESS LOCAL AREA NETWORKS**

**Description:**
- Wireless LAN (WLAN) characteristics.
- Collision domain concept.
- Hidden and exposed node problem.
- WiFi (IEEE 802.11)
  - Physical level and transmission bit rate. Solutions to reduce the interference problems.
  - Medium access protocols.
  - MAC frame format.

**Related activities:**
- WLAN laboratory
- Problems resolution in group

**Learning time:** 16h
- Theory classes: 2h
- Practical classes: 0h
- Laboratory classes: 2h
- Guided activities: 2h
- Self study: 10h
### LAN INTERNETWORKING

**Description:**
- Interconnection devices
  - Concentrators and signal repeaters
  - Routers and gateway
- Switches
  - Bridge and switch internal structure: differences
  - Frame forwarding and learning: Filtering by MAC address
  - Switch backbone capacity
  - Full-duplex mode and flow control
  - Link aggregation
- Spanning tree protocol
  - Redundancy and fiability. Problems from Loops in a LAN
  - Virtual topologies creation. Loops avoidance
  - STP protocol elements.
  - STP messages
  - Topology change
- Virtual LAN (VLAN)
  - Virtual LAN creation
  - Collision domain and broadcast domain concepts in a VLAN

**Related activities:**
- Interconnection devices laboratory
- STP laboratory
- VLAN laboratory
- Problems solving in groups

<table>
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<tbody>
<tr>
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<td>Laboratory classes: 8h</td>
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<td>Guided activities: 4h</td>
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<td>Self study: 32h</td>
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<tr>
<td>MULTIPLE ACCESS PROTOCOLS</td>
<td>Learning time: 17h</td>
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<td>Practical classes: 1h</td>
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<td>Guided activities: 2h</td>
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<tr>
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<td>Self study: 10h</td>
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**Description:**
Random multiple access mechanisms
- Aloha, CSMA family, CSMA/CD and CSMA/CA
Others multiple access mechanisms
- Reserved-Aloha, bit map protocols, RAMA, etc.
Performance evaluation
- Throughput and delay evaluation of protocols
- Real application of media access protocols

**Related activities:**
Problems solving in groups.
### Planning of activities

| (ENG) LABORATORI DE XARXES D'ÀREA LOCAL | Hours: 2h  
Laboratory classes: 2h |
|----------------------------------------|----------------|
| (ENG) LABORATORI DE DISPOSITIUS D'INTERCONNEXIÓ | Hours: 4h  
Laboratory classes: 4h |
| (ENG) LABORATORI DE STP | Hours: 2h  
Laboratory classes: 2h |
| (ENG) LABORATORI DE VLAN | Hours: 2h  
Laboratory classes: 2h |
| (ENG) LABORATORI DE WLAN | Hours: 2h  
Laboratory classes: 2h |
| (ENG) EXAMEN GLOBAL DE LABORATORI | Hours: 1h  
Laboratory classes: 1h |
| (ENG) GROUP-WISE PROBLEM RESOLUTION | Hours: 7h  
Guided activities: 7h |
| Specific objectives: | XX |
| (ENG) PROJECTE DE XARXA | Hours: 6h  
Guided activities: 6h |
| INDIVIDUAL TEST EXERCISES (SUBNETTING) | Hours: 1h  
Guided activities: 1h |
| Description: | Conducting a test of a collection of exercises (subnetting). |
| Support materials: | Collection of exercises. |
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**Descriptions of the assignments due and their relation to the assessment:**
Individual test in class.

**Specific objectives:**
Demonstrate the degree of learning and consolidation of knowledge used in the collection of exercises.

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**Qualification system**

Criteria defined in the infoweb subject will be applied.

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**Regulations for carrying out activities**

Directed activities, controls and laboratory practices are mandatory to pass the subject. Any
Exams and controls are done individually. Directed activities are done in group or individually, as will be specified for each case.

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**Bibliography**

**Basic:**


**Complementary:**


**Others resources:**