Course guides
300021 - IX - Network Interconnection Techniques

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

Degree:
BACHELOR’S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR’S DEGREE IN NETWORK ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR’S DEGREE IN AEROSPACE SYSTEMS ENGINEERING/BACHELOR’S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2015). (Compulsory subject).
BACHELOR’S DEGREE IN AEROSPACE SYSTEMS ENGINEERING/BACHELOR’S DEGREE IN NETWORK ENGINEERING (Syllabus 2015). (Compulsory subject).
BACHELOR’S DEGREE IN AEROSPACE SYSTEMS ENGINEERING/BACHELOR’S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING - NETWORK ENGINEERING (AGRUPACIÓ DE SIMULTANÈTAT) (Syllabus 2015). (Compulsory subject).

Academic year: 2020  ECTS Credits: 6.0  Languages: Catalan, Spanish

LECTURER

Coordinating lecturer: Definit a la infoweb de l’assignatura.
Others: Definit a la infoweb de l’assignatura.

PRIOR SKILLS

X

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


LEARNING OBJECTIVES OF THE SUBJECT


STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours small group</td>
<td>13,0</td>
<td>8.67</td>
</tr>
<tr>
<td>Hours large group</td>
<td>26,0</td>
<td>17.33</td>
</tr>
<tr>
<td>Guided activities</td>
<td>14,0</td>
<td>9.33</td>
</tr>
<tr>
<td>Hours medium group</td>
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<td>8.67</td>
</tr>
<tr>
<td>Self study</td>
<td>84,0</td>
<td>56.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

INTRODUCTION

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

Full-or-part-time: 5h
Theory classes: 2h
Practical classes: 1h
Self study: 2h
LOCAL AREA NETWORKS AND ETHERNET

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

Full-or-part-time: 55h
Theory classes: 8h
Practical classes: 8h
Laboratory classes: 3h
Guided activities: 6h
Self study: 30h

WIRELESS LOCAL AREA NETWORKS

Description:
Introduction
- 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

Full-or-part-time: 16h
Theory classes: 2h
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 reliability. 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

Full-or-part-time: 57h
Theory classes: 10h
Practical classes: 3h
Laboratory classes: 8h
Guided activities: 4h
Self study: 32h

MULTIPLE ACCESS PROTOCOLS

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.

Full-or-part-time: 17h
Theory classes: 4h
Practical classes: 1h
Guided activities: 2h
Self study: 10h
# ACTIVITIES

| (ENG) LABORATORI DE XARXES D’ÀREA LOCAL | Full-or-part-time: 2h  
Laboratory classes: 2h |
|----------------------------------------|--------------------------|
| (ENG) LABORATORI DE DISPOSITUS D’INTERCONNEXIÓ | Full-or-part-time: 4h  
Laboratory classes: 4h |
| (ENG) LABORATORI DE STP | Full-or-part-time: 2h  
Laboratory classes: 2h |
| (ENG) LABORATORI DE VLAN | Full-or-part-time: 2h  
Laboratory classes: 2h |
| (ENG) LABORATORI DE WLAN | Full-or-part-time: 2h  
Laboratory classes: 2h |
| (ENG) EXAMEN GLOBAL DE LABORATORI | Full-or-part-time: 1h  
Laboratory classes: 1h |
| (ENG) GROUP-WISE PROBLEM RESOLUTION | Specific objectives:  
XX  
Full-or-part-time: 7h  
Guided activities: 7h |
| (ENG) PROJECTE DE XARXA | Full-or-part-time: 6h  
Guided activities: 6h |
INDIVIDUAL TEST EXERCISES (SUBNETTING)

Description:
Conducting a test of a collection of exercises (subnetting).

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

Material:
Collection of exercises.

Delivery:
Individual test in class.

Full-or-part-time: 1h
Guided activities: 1h

GRADING SYSTEM

Criteria defined in the infoweb subject will be applied.

EXAMINATION RULES

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.

BIBLIOGRAPHY

Basic:

Complementary: