Course guide
230650 - CN - Communication Networks

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

Degree: MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Compulsory subject).
MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Optional subject).

Academic year: 2023  ECTS Credits: 5.0  Languages: English

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

- Packet switched networks: datagram and virtual circuit oriented.
- Concepts as throughput, network efficiency and occupancy.
- Error control and compression mechanisms. Source coding. Channel coding.
- Medium Access Control algorithms: Aloha, CSMA-CD, CSMA-CA.
- Local Area Networks: Ethernet (hubs, switches, switching tables, spanning tree protocol, VLANs, flow control, autoconfiguration, implementations).
- Communication protocols: IPv4 (fragmentation, subnetting, supernetting, routing tables), ICMPv4, ARP, TCP (sliding window mechanism, flow and congestion algorithms), UDP, HTTP, DNS.
- To be familiarized with communication protocols analyzers: wireshark.
- Linux: medium level for operating system operation and advanced level on network interfaces configuration.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Ability to deal with the convergence, interoperability and design of heterogeneous networks with local, access and core networks, as well as with service integration (telephony, data, television and interactive services).
2. Ability to design and dimension transport, broadcast and distribution networks for multimedia signals
3. Ability to model, design, implement, manage, operate, administrate and maintain networks, services and contents
4. Ability to plan networks and decision-making about services and applications taking into account: quality of service, operational and direct costs, implementation plan, supervision, security processes, scalability and maintenance. Ability to manage and assure the quality during the development process
5. Ability to understand and to know how to apply the functioning and organization of the Internet, new generation Internet technologies and protocols, component models, middleware and services
Transversal:
6. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

7. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

TEACHING METHODOLOGY

- Lectures.
- Application classes.
- Individual work.
- Exercises.

LEARNING OBJECTIVES OF THE SUBJECT

Learning objectives of the subject:

The aim of this course is to train students in access and core network technologies, both wired and wireless and understand the functioning and organization of the new generation Internet technologies, protocols, component models and services.

Learning results of the subject:

- Ability to specify, design networks, services, processes and applications of telecommunications in both fixed and mobile environments, personal, local or long distance, with different bandwidths, in multicast networks, including voice and data.
- Ability to apply both traffic engineering as planning tools, dimensioning and network analysis.
- Ability to analyse, model and implement new architectures, network protocols, communication interfaces and new network services and applications.
- Ability to implement and design the convergence and interoperability of heterogeneous networks considering local, access and core networks.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self study</td>
<td>86,0</td>
<td>68.80</td>
</tr>
<tr>
<td>Hours large group</td>
<td>39,0</td>
<td>31.20</td>
</tr>
</tbody>
</table>

Total learning time: 125 h

CONTENTS

1. Wireless local area networks

Description:
EEE802.11 standard including versions, physical layer, MAC layer and access schemes (PCF and DCF), quality of service, power management, fairness and performance analysis

Full-or-part-time: 33h
Theory classes: 12h
Self study: 21h
## 2. Low-Rate Wireless Personal Networks

**Description:**
IEEE 802.15.4, ZigBee, 6LowPAN and Wireless Sensor Networks

**Full-or-part-time:** 10h  
Theory classes: 4h  
Self study: 6h

## 3. IPv6

**Description:**
IPv6, ICMPv6, autoconfiguration

**Full-or-part-time:** 10h  
Theory classes: 4h  
Self study: 6h

## 4. Routing

**Description:**
Routing algorithms  
Interior Gateway Protocols: RIP, OSPF  
Exterior Gateway Protocols: BGP4  
Routing in MANET

**Full-or-part-time:** 10h  
Theory classes: 4h  
Self study: 6h

## 5. Network virtualization

**Description:**
Concepts and definitions  
Modelling  
Virtual Network Embedding  
Metrics  
Online and Online

**Full-or-part-time:** 12h  
Theory classes: 4h  
Self study: 8h

## 6. Network optimization

**Description:**
Network modelling: Notation, metrics  
Optimization

**Full-or-part-time:** 9h  
Theory classes: 3h  
Self study: 6h
### 7. Core networks

**Description:**
Basic concepts: Classification, traffic aggregation, service categories, QoS, control strategies, fair resources allocation. MPLS and SDN networks: Motivation, architecture, SDN controller, OpenFlow.

**Full-or-part-time:** 18h
- Theory classes: 6h
- Self study: 12h

### 8. Fixed access networks

**Description:**

**Full-or-part-time:** 6h
- Theory classes: 2h
- Self study: 4h

### Final test

**Description:**
Final test

**Full-or-part-time:** 17h
- Theory classes: 2h 30m
- Self study: 14h 30m

### GRADING SYSTEM

Final examination: 60%.
Individual assessments: 40%.

### BIBLIOGRAPHY

**Basic:**

**Complementary:**
524. ISBN 978119013358.