230650 - CN - Communication Networks

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit: 744 - ENTEL - Department of Network Engineering
Academic year: 2019
Degree: MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Teaching unit Compulsory)
MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019).
(Teaching unit Optional)
MASTER'S DEGREE IN INFORMATION AND COMMUNICATION TECHNOLOGIES (Syllabus 2009).
(Teaching unit Optional)
ECTS credits: 5 Teaching languages: English

Teaching staff
Coordinator: JORDI CASADEMONT
Others: A. CALVERAS, X. HESSELBACH, J. PARADELLS

Requirements
It is required to know:
- 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 analizers: 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.
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>Total learning time: 125h</th>
<th>Hours large group: 39h</th>
<th>31.20%</th>
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<tbody>
<tr>
<td></td>
<td>Hours medium group: 0h</td>
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<tr>
<td></td>
<td>Hours small group: 0h</td>
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<td>Guided activities: 0h</td>
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<tr>
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<td>Self study: 86h</td>
<td>68.80%</td>
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## Content

| 1. **Wireless local area networks** | **Learning time:** 32h  
Theory classes: 12h  
Self study: 20h |
|-----------------------------------|------------------------|
| **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. |

| 2. **Low-Rate Wireless Personal Networks** | **Learning time:** 9h  
Theory classes: 3h  
Self study: 6h |
|------------------------------------------|------------------------|
| **Description:**  
- IEEE 802.15.4, ZigBee, 6LoWPAN and Wireless Sensor Networks. |

| 3. **Network level: IPv6 and routing** | **Learning time:** 27h  
Theory classes: 10h  
Self study: 17h |
|---------------------------------------|------------------------|
| **Description:**  
- Global routing and routing within Internet provider's domain:  
  - Algorithms: Distance Vector, Link State.  
  - Protocols: RIP, OSPF, BGP.  
  - IPv6, ICMPv6, autoconfiguration, migration. |

| 4. **Fixed access networks** | **Learning time:** 6h  
Theory classes: 2h  
Self study: 4h |
|-------------------------------|------------------------|
| **Description:**  
- Cooper and optical fibre digital distribution networks: xDSL, FTTX. |
# 5. Core networks

**Learning time:** 18h  
Theory classes: 6h  
Self study : 12h

**Description:**  
- Digital Hierarchies PDH and SDH: Definitions, frame format and hierarchies, SDH mapping.  
- Core networks fundamentals: Service categories, control mechanisms, fairness, fair bandwidth allocation.  
- MPLS networks.  
- SDN networks: motivation, SDN architecture, the controller, OpenFlow controller.

# 6. Network optimization

**Learning time:** 12h  
Theory classes: 4h  
Self study : 8h

**Description:**  
Network modeling: Notation, metrics.  
Optimization: Linear and non-linear programming, complexity.

## Mid term test

**Learning time:** 10h  
Theory classes: 2h  
Self study : 8h

**Description:**  
Mid term test.

## Final test

**Learning time:** 11h  
Theory classes: 3h  
Self study : 8h

**Description:**  
Final test.

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### Qualification system

Final examination: 40%  
Partial examinations and controls: 40%  
Individual assessments: 20%
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Bibliography

Basic:


Complementary:

